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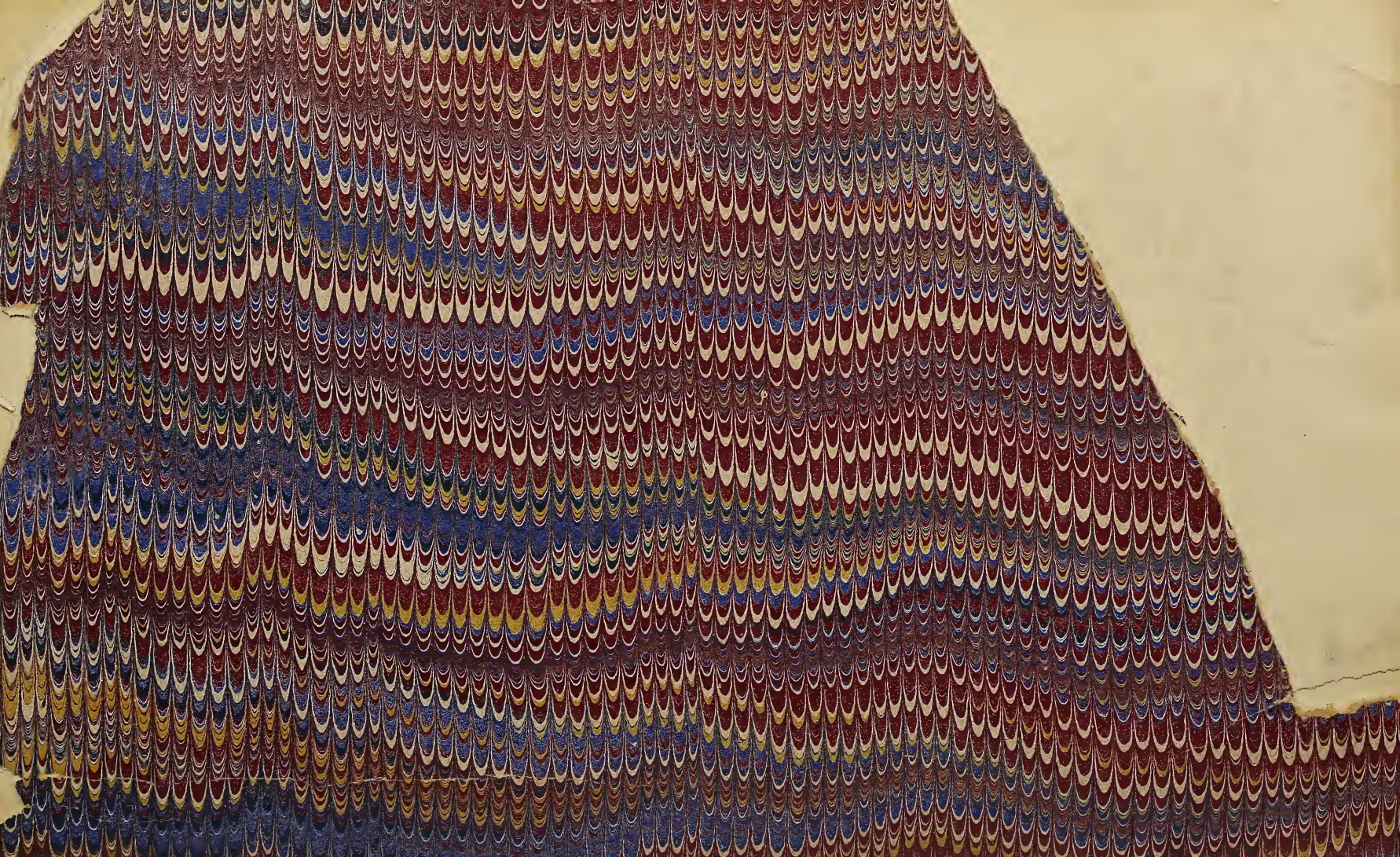

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RANGING A BATTERY.

BY

LIEUT.-COLONEL A. D. ANDERSON, R.A.

CAPTAIN HORNE'S paper in the November (1890) "Proceedings" of the R.A. Institution, did good service, as it cannot fail to have interested in this subject of "Ranging a Battery" a large number of Artillery Officers. Readers of it will remember that he put before his brother Officers the framework of a system by which he proposed to attain that very desirable end, a reduction of the painfully long time it now takes us before we can bring our full shrapnel fire to bear on our foe, and he made distinct proposals of his own. At the same time he invited criticism on them, and thus set many others to work, to think over and consider this same, very important question.

To his paper there were two replies.

In the following notes, I purpose considering :—

1st, Captain Horne's proposal.

2nd, The criticisms that have been elicited.

And 3rd, I will endeavour to lay before my brother Officers for criticism or remark further suggestions for attaining more rapid results in Ranging.

I will commence by saying that in the bulk of the principles enunciated by Captain Horne, I agree, as must, I think, the majority of us.

In so far that—

(*a.*) It is desirable to introduce a development of the bracket system, by which the Commanding Officer will not have to wait for a gun to re-lay at the range he requires after he makes his observation. This should, and can be done, ahead of him, as will, I trust, be seen without running risk of mistakes.

(*b.*) That the No. 1 and layer should not be combined. This is now accepted in the 12-pr. drill and works well.

(*c.*) That the duties of the sections should be conveyed to all, by the position of the Commanding Officer on the windward flank.

(*d*) That all guns for ranging with common shell should load the moment they come into action.

(*e*) That there should be no sounds except from Section Officers, who repeat Commanding Officers' words of command.

(*f*) That if the Commanding Officer has been unable to clearly explain the exact object to be laid upon, he should himself lay the sights of the windward gun on it and cause Sectional Officers to look over them.

Thus far in principles one can agree entirely with Captain Horne, but the details of his plan for working them out are open to criticism, and as most of the weak points have already been brought to notice by writers in the journal, I will proceed to discuss their remarks.

In the "Proceedings" of February 1891, Captain W. L. White, R.A., condemns the attempt to obtain better results, because Foreign Nations have found the system of ranging proposed, to be wanting.

This is no sufficient ground for condemnation; Foreign Nations might with as much reason have condemned breech-loading for Field guns, because the English nation condemned it.

Captain White further on says, the new proposals violate a vital principle, viz., "That all *orders* issuing from a Commanding Officer to subordinates, to whom no power of initiative is delegated, *must be repeated and not interpreted.*"

Now, in so far as concerns the gun about to fire, and a second gun standing ready in case of accidents, I go with him that this order is quite necessary, but if it be urged that five guns shall stand looking on to all intents and purposes idle, while the sixth fires, I say the sooner we cease to hold to such a theory as a vital principle the better.

The Commanding Officer must always have two guns ready or the second in process of being re-laid at the range he wants, but beyond that, the endeavour of the remainder should be to work ahead of him and anticipate his requirements.

As pointed out by Captain White, gun layers will undoubtedly be confused in the heat of action, but I think it can be shewn that there need be no calling out of many ranges; the only range or elevation called out will be that at which the Commanding Officer wishes a gun to fire; this, instead of confusing them, will be a basis whereon to correct their mistakes when they have erred.

Sectional Commanders or the Commanding Officers may be put out of action; this might happen under any scheme, but no further dislocation of work should occur than under the present system.

It was undoubtedly a weak point in Captain Horne's proposal that after the range was first given, guns were fired at the command "Shot" and it was not till the fifth or sixth round that a range was again given. The Commanding Officer had no guarantee, without asking questions, that guns were being fired as he required, and the Officers and Nos. 1 had no certainty that they were firing at the range the Commanding Officer expected from them.

To be sure of this is an absolute necessity, and the result is attained with complete certainty by the Commanding Officer calling out the range he wants a gun fired at each time, after he makes his observation. If the drill has been properly performed he will find a gun ready for him, and a second being re-laid at that range, and if mistakes have

been made, as under every scheme they will be made, he must wait till the proper gun to fire corrects its mistake. No other gun is concerned.

The Commander or the N.C.-O., usually an observer, working with him, must keep a table on blank form and fill in the ranges as ordered, so that if the Commander is shot the table is on the spot to guide his successor. In like manner Sectional Officers should keep a record. They may possibly perform all their work in their heads, because after the first range, it is purely a see-saw between the windward and centre sections. I, however, consider they should all have blank tables ruled out in their pocket-books and fill in the ranges as they go along. Among many other aids which it will afford, it will give them at a glance (if by any chance anything distracts them) what every gun is doing, and will leave a distinct record for the man who takes their place if they become disabled.

A succession of doubtful observations would undoubtedly have caused trouble under Captain Horne's proposal, but I trust it can be shewn that this difficulty can be overcome.

On the whole, although Captain White has pulled Captain Horne's efforts to pieces, his paper only contributes to the general result—a prophesy of what may happen in the future, which unfortunately in no way assists us.

Captain Buckle, on the other hand, points out several facts which must receive consideration in any scheme for ranging.

Five guns out of six may possibly only get into action; one or possibly two of these may be disabled before range can be found, leaving the Battery Commander four or perhaps only three guns to complete his ranging with. I trust it can be shewn (see Table D.) that so long as three guns remain to the Commanding Officer the system proposed can be adhered to with the result of an increase in the rate of fire. Below three guns it is not necessary to go; for such exceptional occasions, special provision must be made.

Rounds will also be "Doubtful;" this is best met, as will be seen from Table C, by allowing the section getting a doubtful result to continue its fire at that range until a decisive judgment can be given; all others meanwhile "Stand fast."

It is undoubtedly important that a number of heads and hands in a battery should not be working ahead (independently) of the Commanding Officer.

This is guarded against by the Commanding Officer calling out the number of yards or the elevation at which he wishes a gun fired; the proper gun under the scheme then fires; none are ahead of the Commanding Officer but the *two* guns taking the arms of the Bracket.

Captain Buckle then suggests a modification of Captain Horne's proposal, and owns that in many cases the Commanding Officer *must* know before firing many of the rounds, exactly the range that will next be required, or that it will be one of two.

This, the Sectional Officers know as well as he does, and so long as two guns in the battery are always ready to fire or in the act of laying at the range the Commanding Officer wants, it is only giving needless trouble to cause four other guns to keep on re-laying at the range

ordered, and losing time; because as will be shewn, somewhat on Captain Horne's plan, guns can be ready laid in anticipation.

In conclusion, Captain Buckle advocates opening fire with shrapnel without ranging, if time be of value. To do this we must get far more accurate results from range-finding than are now attainable. A very attractive but, I think, as would be found, if tried, a difficult process, and our endeavour for some time to come must, I fear, be to accelerate our method of ranging under present conditions.

Towards this end, the following scheme is put forward for remark and criticism. I claim for it no originality, as it is obvious it is based on the writings in the three papers, above quoted, in the R.A.I. "Proceedings," nor is it solely my own work, for I have throughout received most valuable assistance from Major F. Burridge, R.A., Commanding the 50th Battery, who, with his officers and men, have worked it out in every possible and impossible way.

By this means I trust weak points have been detected and rectified, and a workable system arrived at. In explaining the scheme and in enunciating our views, it may save future writing if I enter a running explanation of reasons, objects, &c.

General Principles.

1. The C.O. places himself on the windward flank in action.

2. The C.O's. words of command must be passed on quietly by the Section Commanders.—No other words of command are necessary.

3. The gun laid at the range or elevation ordered by the C.O. to fire. If two or more be laid at the one range, then the leeward gun.—The No. 1 not to make ready until *his* range is called out, when he turns his head towards his Sectional Commander, who orders fire by dropping his hand.

4. Duties of Sections to be detailed at "Prepare for action," as follows.—It is very desirable that even with a reduced number of guns, the three section system of dividing the work should be maintained, although the C.O. may have to tell off the guns afresh:—

Leeward Section—*Shrapnel Section.* *See* Examples.

Centre and Windward Sections.—*Ranging Sections.* In the event of four guns being in action—2, 4, 5 and 6. Wind from left.

No. 2 prepares for shrapnel.

No. 4 takes duties of centre section.

Nos. 5 and 6 " " left section.

If, say, only three guns remain, 1, 3, 6, or 2, 4, 5, they take duties of a section each.

5. The sub-divisions of the Shrapnel section bring up three shrapnel fuzed with time fuzes.

Those of the Ranging sections, one common shell in the gun and two

in the magazine, all fuzed with percussion, and one shrapnel with time fuze also in the magazine.

They, the latter, complete loading and lay as soon as they get into action.

Shrapnel must be replaced as expended; additional common shell should only be required on special occasions, and should be replaced under special orders from the Nos. 1, who must bear in mind that the last common shell should not be fired without being replaced.

6. The Shrapnel section prepares for shrapnel from the first. The Ranging sections on the order "Shrapnel."—It will be found that with one shrapnel shell fuzed these ranging sections have ample time to prepare, as they cannot clamp fuzes until the first two shrapnel have been observed.

7. On coming into action, or, if possible, before, the C.O. will call out the range or elevation, and the bracket in yards or minutes.

The Centre section always takes the range.

The Windward section always takes the arms of the bracket.

8. The long arm of the bracket must always be next the C.O.

9. Two guns must always be laid, or the second gun must be in the process of being re-laid at the range required by the C.O.

See examples :—

One gun laid 1800
„ „ „ 2200 } of same section.

C.O. orders 1800. The gun laid at 2200 is at once re-laid at 1800, and should be ready in time, in case another round at that range is wanted. In the event of a third round or more being wanted at the one range, the guns of that section continue loading and laying, till a decided observation can be made or a change of range is ordered.

10. The C.O. orders "Shot" in the first round to commence the firing, after that the range, elevation or length of fuze (if shrapnel has been ordered), being called out is the signal to the gun concerned to fire.

11. The process of ranging is a see-saw between the Centre and the Windward sections; one takes the range, the other the two arms of the bracket, whatever that may be.—Each range is called out by the C.O. Thus, even if mistakes happen, delay only occurs while those who are wrong correct their laying. If the C.O. is uncertain of his men, he can assist them further as follows :—

Left section 2100, bracket 50, or even still further by saying centre section 2150–2050, but this would very rarely be necessary.

He can also put the battery right in this manner, should they have got mixed up at any moment or have becomed confused.

12. In the event of a "doubtful" round, the C.O. calls out "Doubtful," the guns of the section in which it occurs continue loading and laying at the same range until a correct observation has been obtained.

13. As soon as the mean of the short bracket is ordered, the gun so laid fires, the remaining guns loaded, re-lay at once at that range, and take up the fire when ordered, commencing with the leeward gun.

14. The Shrapnel section, follows in its laying the ranges called out by the C.O. who, as soon as he has fixed the mean of the short bracket, or commences verification, gives the length of fuze.

They then clamp fuzes and load.

In the Ranging sections, guns which have been fired at either arm, or the mean of the short bracket, or which have obtained "Range" or "Palpable hit" do not re-load without orders, unless the firing should be with a reduced number of guns, when they continue to re-load with common until ordered to cease doing so.

If any further verification be required by the C.O. he specially orders the same from the windward section; the centre section prepares for shrapnel.—This should only be requisite in case of bad laying or doubtful shots. *See* Example A (II).

15. If "Range" or a "Palpable hit" be obtained, the C.O. calls that out. The gun of the section laid at that range fires at once, and the other two guns which are loaded re-lay at the same range. Verification is continued from the leeward gun.

After the second round at the one range the C.O. should be in a position to order the fuze.

16. If a shot falls very much short or long, in fact, undoubtedly outside the bracket given by the C.O., he must make a bold increase or decrease of range (400 or 500 yards). This is taken up by the section taking the range, the other Ranging section changing its ranges for the arms of the bracket, at each change of range or elevation. *See* Example B. (I.)

17. Shrapnel fire will commence on the command "Shrapnel," and the two guns of the Shrapnel section are fired in succession at "Rapid fire" rate, without any further command. The Centre section stand ready to clamp at the same length of fuze, or set at another.

18. On the command "Ordinary" or "Rapid fire," the gun next to windward of that last fired is the next to fire (if loaded) unless otherwise ordered, and so on in succession.

For Examples—*See* Tables. A "Dash" below a range denotes the gun that has just fired and is being laid at the range given below the "Dash."

EXAMPLES.

A.—ORDINARY ROUNDS.—(I.)

No. of Round.	Words of Command. C.O.	No. of Gun.	6	5	4	3	2	1	Result.	Remarks.
1	2000*. Bracket 200 Shot	4	...	...	2000	2000	1800	2200	+	Wind from right.
2	1800	2	...	...	1700	1900	1800	1800	−	
3	1900	3	...	...	1900	1900	1850	1950	+	
4	1850	2	...	...	1825	1875	1850	1850	−	
5	1875. Fuze 8-5 ...	3	...	...	1875	1875	...	1875	+	
6	1875	4	...	...	1875	...	...	1875	+	
7	1875	1	...	...	...	...	...	1875	−	
8	Shrapnel. Fuze 8-5	6	1875	1875	1875	1875	...	...	15′	above plane.
9	—	5	1875	1875	1875	1875	...	...	15′	
10	Keep to fuze 8-5 ...	4	1875	1875	1875	1875	1875	1875		
	Ordinary Fire. (II.)									
1	2000. Bracket 100. Shot	3	2100	1900	2000	2000	...	...	−	Wind from left.
2	2100	6	2100	2100	2150	2050	...	...	+	
3	2050	3	2075	2025	2050	2050	...	...	+	
4	2025. Fuze 9-5 ...	5	2025	2025	2025	...	...	...	−	
5	2025	4	2025	...	2025	...	...	...	−	
6	2025	6	2025	...	...	...	...	...	−	
7	Left section 2050 ...	5	2050	2050	...	...	...	...	+	
8	2050	6	2050	...	...	...	...	...	−	
9	Shrapnel. Fuze 9-5	1	...	...	2050	2050	2050	2050	80′	
10	—	2	...	...	2050	2050	2050	2050	80′	
11	Fuze 11	3	2050	2050	2050	2050	2050	2050	8′	
12	—	4	2050	2050	2050	2050	2050	2050	8′	
	Keep to Fuze 11 Rapid Fire.									

Note.—Three minus observations having been got in the 2nd Example at 2025, the range is increased to 2050.

The above ranging is, in so far as concerns verification on the mean of the short bracket, based on the Indian instructions. The Field Artillery drill-book, however, enjoins verification on the lesser of the two elevations of the short bracket.

This, with a gun like the 12-pr. B.L., will, I believe, be found to be a safer and more expeditious principle, as if we are to err, better let it be by being under, rather than over; some examples on this latter principle are therefore given.

*If ranging with Telescopic sights, the principle is exactly the same, the word of command being 2° 40′, shot; the Centre section take 2° 40′; the sub-divisions of the Right 2° 20′ and 3° respectively.

A. (III.)—ON PRINCIPLE IN FIELD ARTILLERY DRILL-BOOK.

No. of Round.	Words of Command by C.O.	No. of gun.	6	5	4	3	2	1	Result.	Remarks.
1	2000. Bracket 200. Shot	3	2200	1800	2000	2000	...	...	—	Wind from left.
2	2200	6	2200	2200	2300	2100	...	...	+	
3	2100	3	2150	2050	2100	2100	...	...	+	
4	2050. Fuze 9-5 ...	5	2050	2050	2050	2050	...	...	—	
4	2050	3	2050	...	2050	2050	...	...	—	
5	2050	4	2050	...	2050	...	...	...	+	
6	2050	6	2050	...	...	...	...	...	+	
7	Shrapnel. Fuze 9-5	1	...	...	2050	2050	2050	2050	80′	
8	—	2	...	..	2050	2050	2050	2050	80′	
9	Fuze 11-1	3	2050	2050	2050	2050	2050	2050	5′	
10	—	4	2050	2050	2050	2050	2050	2050	5′	
	Keep to Fuze 11-1—Rapid Fire. (iv.)									
1	1700. Bracket 100. Shot	4	...	...	1700	1700	1600	1800	+	Wind from right.
2	1600	2	...	...	1550	1650	1600	1600	−	
3	1650. Fuze 7-3 ...	3	...	...	1650	1650	1650	1650	+	
4	1650	4	...	...	1650	...	1650	1650	+	
5	1650	2	...	...	...	...	1650	1650	+	
6	1650	1	...	...	...	...	...	1650	−	
7	Shrapnel 1625. Fuze 7-3	6	1625	1625	1625	1625	...	...	10′	
8	—	5	1625	1625	1625	1625	1625	1625	10′	
	Keep to Fuze 7-3—Ordinary Fire.									

Under the above plan, it is necessary to fire off four verifying rounds, as four guns are always ready loaded when the C.O. comes to the half hundred range. There does not appear to be any disadvantage in this; the drill-book suggests three to six rounds.

If half the results are plus and half are minus, the range has been found.

If $\frac{3}{4}$ are + and $\frac{1}{4}$ −, range might be reduced 25 yards.
If $\frac{3}{4}$ are − and $\frac{1}{4}$ +, " " " raised 25 yards.
If all − or all +, increase or decrease 50 yards.

B. (I.)—FIRST SHOT VERY SHORT.

No. of Round.	Words of Command. C.O.	No. of gun.	6	5	4	3	2	1	Result.	Remarks.
1	2000. Bracket 200. Shot	4	...	...	2000	2000	1800	2200	—	Wind from right.
2	2500. Bracket 200. Shot.	3	...	...	2500	2500	2300	2700	—	
3	2700	1	...	...	2600	2800	2700	2700	—	
4	2800	3	...	...	2800	2800	2750	2850	+	
5	2750	2	...	...	2725	2775	2750	2750	—	
6	2775. Fuze 14 ...	3	...	...	2775	2775	...	2775	—	
7	2775	4	...	...	2775	...	...	2775	+	
8	2775	1	...	...	...	...	...	2775	+	
9	Shrapnel. Fuze 14	6	2775	2775	2775	2775	...	...	10′	
10	—	5	2775	2775	2775	2775	...	...	10′	
	Keep to Fuze 14—Ordinary Fire.									

Note.—In the event of the jump of 500 yards given after the first shot not being sufficient, the C.O. makes another bold rise in the same section, and so continues until he has got inside the bracket for the range.

B. (II.)—DOUBTFUL ROUNDS.

1	4000. Bracket 400. Shot	3	4400	3600	4000	4060	...	...	—	Wind from Left.
2	4400	6	4400	4400	4600	4200	...	...	?	
3	Doubtful. 4400. ...	5	4400	4400	4600	4200	...	...	?	
4	Doubtful. 4400. ...	6	4400	4400	4600	4200	...	...	+	
5	4200	3	4300	4100	4200	4200	...	...	—	
6	4300	6	4300	4300	4350	4250	...	...	?	
7	Doubtful 4300	5	4300	4300	4350	4250	...	...	+	
8	4250	3	4275	4225	4250	4250	...	...	—	
9	4275 Percussion Fuze	6	4275	4275	4275	...	...	...	+	
10	4275	4	...	4275	4275	...	...	...	+	
11	4275	5	...	4275	...	...	...	...	—	
12	Shrapnel Percussion Fuze	1	...	...	4275	4275	4275	4275		
13	—	2	...	...	4275	4275	4275	4275		
	Keep to Percussion Fuze—Ordinary Fire									

Note.—The number of doubtful results is immaterial.

C. (I.)—RANGE.

No. of Round.	Words of Command. C.O.	No. of Gun.	6	5	4	3	2	1	Result.	Remarks.
1	1400. Bracket 100. Shot	4	...	...	1400	1400	1300	1500	Range	Wind from Right.
2	Range, 1400	3	...	...	...	1400	1400	1400	+	
3	1400, Fuze 5-9... ...	2	...	...	...	...	1400	1400	+	
4	1400	1	...	...	...	...	...	1400	—	
5	Shrapnel. Fuze 5-9	6	1400	1400	1400	1400	...	...	12′	
6	—	5	...	1400	1400	1400	...	...	12′	
	Keep to Fuze 5-9—Ordinary Fire.									

(II.)—PALPABLE HIT.

1	2500. Bracket 200. Shot	4	...	...	2500	2500	2300	2700	Hit.	Wind from Right.
2	Hit, 2500	3	...	...	...	2500	2500	2500	—	
3	2500. Fuze 12-3 ...	2	...	...	...	...	2500	2500	—	
4	2500	1	...	...	...	...	...	2500	—	
5	Right section 2525. Centre section prepare for shrapnel	2	...	...	...	...	2525	2525	+	
6	2525	1	...	...	...	...	...	2525	—	
7	Shrapnel. Fuse 12-3	6	2525	2525	2525	2525	...	...	15′	
8	—	5	2525	2525	2525	2525	...	...	15′	
	Keep to 2525. Fuze 12-3—Ordinary Fire.									

Having got three minuses after the hit, the C.O. is justified in believing round No. 1 was over-laid, and should increase by 25 yards.

If round No. 2 was well up to the target, he is justified in ordering length of fuze; if in doubt, it would be well in a case like this to wait till after he has got a plus observation.

D. (I.)—A REDUCED NUMBER OF GUNS.

No. of Round.	Words of Command. C.O.	No. of Gun.	6	5	4	3	2	1	Result.	Remarks.
1	2000. Bracket 200. Shot	4	...	...	2000	...	1800	2200	+	Wind from Right.
2	1800	2	...	...	1900	...	1800	1800	—	Only numbers 6, 5, 4, 2 and 1 in action.
3	1900	4	...	...	1900	...	1850	1950	—	
4	1950. Fuze 9	1	...	...	1975	...	1950	1950	+	
5	1925	4	...	...	1925	...	1925	1925	+	
6	1925	2	...	...	—o— ...	...	1925	1925	+	
7	1925	1	...	...	...	...	...	1925	—	
8	Shrapnel. Fuze 9 ...	6	1925	1925	...	...	...	...	20′	
9	—	5	1925	1925	1925	...	1925	1925	20′	
	Keep to Fuze 9— Ordinary Fire. (ii.)									
1	3800. Bracket 400. Shot	3	4200	...	...	3800	...	...	?	Wind from Left.
2	3800	3	4200	...	...	3800	...	...	+	Only guns 6, 3, and 2 in action.
3	3400	6	3400 —o—	...	...	3600	...	...	—	
4	3600	3	3700	...	...	3600	...	...	+	
5	3500	6	3500 —o—	...	...	3550	...	...	+	
6	3450. Percussion Fuze	3	3475	...	...	3450 —o—	...	...	—	
7	3475	6	3475	...	...	3475	...	...	—	
8	3475	3	3475	...	...	3475	...	...	+	
9	3475	6	3475	...	...	...	...	...	+	
10	Shrapnel. Left and centre sections prepare for shrapnel	2	...	...	...	...	3475	...		
11	—	6	3475	...	...	...	3475	...		
12	Keep to Percussion Fuze		3475	...	...	3475	3475	...		
	Ordinary Fire.									

With a reduced number of guns, the work must of course be a little delayed, but no difficulty should arise if the sectional system be adhered to. If no gun of a section be left in action, as for instance only 1, 2, 3 and 4, wind from right, the C.O's. order should be—Duties, 1 and 2 of Right, 3 of Centre, and 4 of Left section; or, if 4, 5 and 6 were only Left, wind from right; duties, 4 of Right, 5 of Centre, and 6 of Left section.

A single gun laying for a section lays at the higher of the two ranges and depresses if required, delay must occur while this is being done. The system will work advantageously with three guns.

Symbol —o— below a range denotes gun being depressed to the lower arm of the bracket.

At first sight, many will be impressed with the idea that a system of this sort is beyond the capacity of the majority of N.-C. Officers and of some Officers. I feel certain this is not so, if only a very short time be given to studying the tables.

There is absolutely nothing for a sectional officer to carry in his head, and the C.O. can personally detail in his first order, or at "Prepare for action," or at any moment he chooses the exact range each gun should be laid at.

After the first start, a see-saw of the simplest description has to be maintained between the two ranging sections, in which it is impossible for a man who fills up in pencil a blank table, as he goes along, to make a mistake. Should, however, such a *contretemps* occur, the battery simply has to wait until the range is altered by the erring No. 1, in accordance with what the C.O. has called out.

Some who have learnt the system will be tempted into carrying their own share in their heads; but, as I said before, this is to be deprecated. One man may undoubtely do this and do it well, but when an accident comes, and this we have to legislate for, a reliable record should be on the spot, ready and up to time, for whoever has to carry on the work.

That men will have to be trained for such a system is undoubted, but do not we see around us on every side marked advances in the standard of intelligence attained by and obtained from our N.-C. Officers and men. What more striking example can we have than the present signal drill, where no voice is heard but the C.O.'s., as compared to the drill of 30 years ago when, with a noisy C.O., everyone down almost to the 2nd Trumpeter, had a shout whenever he got a chance. That a very moderate amount of careful training yields good results is testified to by Captain Horne's experience with his battery and Major Burridge's with the 50th Field Battery. In the latter case it has taken an average of 3 minutes 25 seconds to range, up to firing the first shrapnel without accidents. This is the result of a very short spell of practice.

Assuming that a system of this description is found to work well, the advantages that may be claimed for it are :—

(*a*).—The sole attention of one Section is given to shrapnel.

(*b*).—Four guns being sufficient for finding the range, the four nearest to the C.O. are utilised.

(*c*).—Supposing that the C.O. is accurate, mistakes, beyond of a momentary nature, can barely occur, as the C.O. keeps them all straight each time he calls the range out.

(*d*).—Fewer shots are wasted, as fewer guns are loaded at a time, than under the present system.

(*e*).—Bar accidents, which will occur with any system, the time occupied in ranging is immensely reduced.

(*f*).—Under the system now in force the C.O. has to wait for the guns; by this way of working, the guns have to wait for the C.O. (observing with puffs).

(*g*).—No guns have to be unloaded or needlessly fired off.

(*h*).—Nothing in this plan precludes a C.O. from falling back on "Slow fire" from either flank should he have too few guns or men left.

THE WORLD'S WAR-SHIPS,

FROM A GUNNER'S POINT OF VIEW.

BY

MAJOR W. J. ROBERTSON, R.A.

First Part—BRITISH.

It is not much good sending a man to shoot an elephant unless he knows where to hit it. Having provided him with a good shooting weapon, and taught him how to use it, you must go a step further and show him where to aim.

In coast batteries this is important: the ordinary Garrison gunner is usually somewhat ignorant of a ship's mechanism. Ask him where he intends laying on the ship that is passing, and you are fairly certain of getting the answer, "behind the funnel, so as to disable the engines."

Now, he is so far right that this would probably bring up in a round turn the ordinary coasting steamer on which he is practising training his gun; but in war he will get few chances like this, and as to stopping a cruiser of the Aurora class, he might as well try peppering a tiger on its rump with buckshot.

Probably, when hostilities broke out, the Naval Intelligence Department would supply coast batteries with descriptions of the ships likely to pass their zone of fire; but, in many cases, this might arrive too late at foreign stations, while it is extremely probable that much of it might be unintelligible to a landsman, through lack of nautical terms. Thus, "May be easily distinguished by her topgallant forecastle, electric light sponsons, and standing rigging secured inboard," conveys little to the R.A. mind, let alone such an expression as "knee of head." Yet the Navy might truly respond that they could find us information, but not brains. The problem is not an easy one, and it is difficult to see how it can be entirely got over till Garrison batteries have in their midst men who have served a cruise on a sea-going ship.

One, however, hopeful sign is, that soldiers are always as keen to learn about ships, as well as sailors about soldiering, so that a few lectures on types of ships and where to hit them will always be listened to with interest, and provoke rivalry and emulation in distinguishing them.

As we are not likely to have an experience similar to the Chilians, there is, of course, no necessity to learn what our own ships are like, but as they form the bulk of the vessels that pass along our zone of fire, and as they naturally prove to us more distinguishable by name, I propose here giving a short account of our own ships from the point of view in question, as a ready means of practising and teaching the men; followed by a similar account of foreign navies.

Let me commence by stating that nothing will be original, I must altogether disclaim here being much more than an indexer, and must tender my best thanks to the authors and editors of the works I have consulted, a list of which I append.

Beginning then with armoured ships of the British navy, we find the earliest in point of date, "the Nestor of the Fleet," as Lord Brassey terms her, the Black Prince.

Though completed in 1862, she is still in commission, together with her sister ship, the Warrior: the first two armoured ships built in this country, they are easily distinguished, as they are long handsome-looking frigates, masted and rigged in the usual way, and formed with a bow and stern like the wooden frigates themselves. They are what are termed broadside ships, that is carry their armament on the main deck, 14 guns on either side, fired out of square ports. These port-holes alone afford an easy mode of recognising them. The armour consists of 4·5 inches of iron extending to a little beyond the bow and stern ports. With such a moderate defence it is, however, hardly worth considering in this or similar cases the question of penetration, the more especially when we remember that in these older types the ship will have to be brought broadside-on to the fort in order to allow her to fire her guns in return.

The Achilles comes next, having been built two years later, she is just about the same size and length and carries the same thickness of armour which, however, runs the entire length of the ship at the water's edge, though it extends higher over the gun ports, which are pierced for 13 guns. Her straight stem would distinguish her from the Black Prince or Warrior.

In the same year, 1864, the sister ships Hector and Valiant were completed, they are much smaller boats, though built on the same plan and having the same armour. 10,000 tons displacement has given way to under 7000, they are, therefore, only 280 feet long instead of 380 feet, though their beam is only two feet less—56 feet instead of 58 feet. They are pierced with 15 gun ports on either side, but in order to accommodate this large battery the guns have to be brought very much further fore and aft than in the preceding vessels. In the Black Prince and Achilles they do not extend to the foremast or mizen. The stem, too, forms an incipient ram so to speak.

We now come to the long ships, Minotaur, Agincourt, and Northumberland, 400 feet long and 60 feet beam. Their five masts have long noted them as unique. They, too, are broadside ships; 20 guns on either side have the first two, their armour being 5·5 inches thick and extending from stem to stern. The Northumberland is of a different type. She has but 11 gun ports on each side, and is now rigged as a

barque.[1] Her iron plating is higher in the central battery, though it extends in a narrower belt throughout the ship's length. All three have the reverse-curved, swan-breasted bow. Originally her armour was the same height throughout, but part has been removed.

From this time forth far shorter ships prevail, the long vessels having been found awkward to manœuvre. Now again, twin screws having been introduced, we are fast approaching the old types; short vessels proving bad at keeping up their speed in a heavy sea.

A long advance, however, was made with the Bellerophon, the first of the central battery ships. She has also a double bottom, while her construction differed structionally from the earlier ships. Her armour is six inches, running in a narrow belt from stem to stern, while an additional belt runs on the top of this for 98 feet of her length, then passing at right angle across her, thus forming a rectangle. This provides cover for the central battery of 10 8-inch B.L. guns, while the same height of armour runs round her bow, where she has mounted four 6-inch ditto. She was also the first ship built with a ram; the form of her bow enabling her to give a bow fire from her 6-inch guns though she was unable to thus use the guns in her central battery. She has also lighter guns in the open. It will be observed that here the extra height of armour is used to protect her armament and gun crews. Her length is but 300 feet. She has two funnels, standing above the central battery.

The Hercules, a little larger, is an improved Bellerophon. Her armour is similarly put on, except that the curious form of double bow has disappeared, the belt running up to her bow; while a similar battery is formed at her stern for stern chasers. But the chief improvement consisted of recesses in the ship's sides forward and aft of the battery; thus making four ports in the corners of the central battery, from which they are able to fire within a few degrees of the line of keel. Her armour is of the thickness of nine inches at the water-line, and extends three feet above and 3·5 feet below it, of eight inches on the most important parts of the battery and six inches elsewhere. Mr. Reed, her designer, says:—

> "The total thickness of iron (neglecting the girders and frames) is, then, 11·25 inches, and of this nine inches are in one thickness; the teak backing has a total thickness of about 40 inches. The trial at Shoeburyness of a target constructed to represent this part of the ship's side, proved that it was virtually impenetrable to the 600-pr. gun,[2] and perhaps no better idea of the increase of the resisting power of the sides of our ironclads can be obtained than that derived from a comparison of the 68-pr. gun which the Warrior's (and Black Prince's) side was capable of resisting with the 600-pr. tried against the Hercules' target."

Here, then, is a vessel that requires skill in hitting, since on the water-

[1] I have doubts about this at present, but it was the fact in 1882 at least.

[2] Armstrong.

line it can resist the shot of, say, all R.M.L. guns below the 12·5-inch and the 9·2-inch B.L., except under unusually favourable circumstances. She would be easily distinguished from the older ships by her clearly marked central battery with its cut out recesses, her single funnel, ram-shaped bow, and main and mizen masts placed close together. The moral would be, aim at her undefended sides, fore and aft of her battery, and three feet above the water's edge, if firing from guns unable to pierce her armour.

A similarly constructed ship is the Penelope, though only half her tonnage. The bow and stern guns are here wanting, their work being performed by the corner guns of her 8-gun battery. She has, however, only six inches and five inches of armour, though now furnished with twin screws. She possesses the distinction of only drawing 17 feet of water, and can, therefore, venture into much shallower water than any of our other sea-going ironclads. Though furnished with a ram, she has not the swan-breasted bow, and would be easily marked by her stern window ports, single funnel, and high bow.

The Sultan is an improved Hercules, with the same thickness of armour, but an improved armament owing to an upper battery. Thus only the bow guns of the central battery were furnished with recesses as in the former ship, the stern fire being delivered from the upper battery. She, too, like the Penelope, has no bow or stern battery. It is hardly worth while considering her, for if refitted after her recent foundering she is likely to be much altered. Her double funnels and two tier of guns over the after part of her battery served to distinguish her.

This carries us on the Audacious class. The novel proceeding in English building of six similar ships being laid down together being now inaugurated. Of these, five yet remain in the service; the sixth, the Vanguard, having been sunk by collision with her sister, the Iron Duke.

The Audacious, Iron Duke, and the Invincible are precisely alike. In the first place the central battery has developed into a double tier with six guns on the main and four on the upper deck. Secondly, by means of an enlargement of the upper works, so as to hang over the ship's side, the guns in the armoured citadel or upper tier can fire directly ahead or astern, thus doing away with the recessed ports which had in turn superseded the small bow and stern batteries. Otherwise the belt and central battery, as it is termed, remained unaltered. Owing, however, to the diminished size, 6000 instead of 8700 tons displacement, the armour had to be only eight inches and six inches, instead of that on the Hercules. The Triumph and Swiftsure were similar, except that the central battery was slightly different and they were sheathed in wood and copper. With regard to armament, the Triumph now carries 10 9-inch M.L.R., four 5-inch B.L., 16 Q.F., and four machine guns. They have all one funnel and ornamental large stern ports. Their overhanging citadel serves to distinguish them, together with their want of length.

Before proceeding further with the broadside ships, it will be best to turn back a minute to consider the turret vessels.

These came to us in a double sense from the Americans, for not only did the idea of monitors for coast defence come to us from them, but our first two vessels of this type, the Scorpion and Wyvern, yet in the service, were seized and purchased by the British Government during the war between the North and South. Except for the sake of development it is hardly worth considering them, they have only five inches of armour, and have two turrets of octagonal form, each of which contains two 9-inch M.L.R. guns. These ships had masts and were fully rigged, but rolled so heavily in a sea that their heavy guns could not be worked. Owing to the persistent advocacy of Captain Cowper-Coles, they were succeeded by the Prince Albert and the Monarch, followed by the Captain. The former two are yet in the Navy List.

The Prince Albert had four turrets of 10 inches of iron, her sides having only six inches, she had the same armament as her two predecessors. The turrets were placed in the middle line of the deck, which sloped downwards towards the water, with shifting bulwarks.

The Monarch was over twice the size of the other three, *i.e.*, 8300 tons, and was an attempt at a full-masted ocean-going turret-ship. As can be imagined, the first difficulty in such a vessel is to place the guns so that their fire and arcs of training may not be interfered with by the masts and rigging. This Sir E. Reed here accomplished, by placing over the two turrets a lofty upper deck, from which the ropes could be worked clear of the turrets, and for keeping the standing and running rigging out of the way of the guns. To make up for the loss of right-ahead fire from the turrets, two forecastle 6·5-inch guns were protected with armour. The belt consisted of seven inches to six inches, and the turrets of 10 inches and eight inches. There is also a stern chaser protected with iron. No one can mistake her. The one solitary type of a masted turret-ship we have with one exception (the Neptune). Covered only by a narrow belt, with the exception of her sides under the turrets, she offers a good mark for even light guns to annoy her.

Captain Coles not being satisfied at the joint ship of Sir E. Reed and himself, obtained permission for the ill-fated Captain. This put an end to masted turret-ships, and once masts are swept aside a thousand difficulties are laid.

These later ships naturally followed the lines at first of the smaller vessels designed for coast defence. The earliest of this latter class was the Cerberus, yet in Colonial service. She is 3350 tons displacement and 225 feet long, with 45 feet beam. The armour-plating is eight to nine inches thick; the exposed sides only three feet in height, and the decks shell proof. A well-armoured breastwork surrounds the base of the turrets, which are two in number, and contain two 10-inch M.L.R. guns. It is the breastwork which forms the characteristic of this class, raising the freeboard of the ship for quite half its length. The Magdala and Abyssinia are similarly ships belonging to the Indian Marine. Although built for coast service, they accomplished the voyage to Bombay during the winter season without incident. As they are protected by armour wherever seen, there is little use firing at them except with guns capable of piercing them. They have been

commended as the handiest vessels for harbour defence ever built. We can be glad that as such, *i.e.*, coast defenders, we can leave the attacking them to the Naval service. They were followed by the Hotspur, also for coast defence. She is provided with a ram and a single oval *fixed* turret, with one 25-ton M.L.R. gun. The reason for this being that, as she was intended principally for ramming, it was thought the turret might otherwise suffer injury from the sudden shock of collision. She was fitted with small masts, and has an armoured breastwork extending between them on which the turret is placed forward, and a flying deck aft. She has lately had a moving turret substituted for the fixed one, which contains two guns. Her armour is 11 inches on the waterline of the belt, eight inches on the breastwork and on the turret, new compound armour 2·75 inches steel and 5·75 inches of iron abaft the breastwork.

A year later the Glatton was built, she is quite without masts, except a military one for signalling. Her sides are encased with iron plates of 12 inches thickness at the top, decreasing in thickness as you descend below the water. The turret was from the first moveable, and contained two 12-inch M.L.R. guns. It is mounted on a breastwork which extends about a third of the length of the ship. Above this is an extensive flying deck which, if shot away, would not interfere with the working of the vessel. It is more for a look-out than for any other purpose. She has also a ram, but not a swan-breasted stem like the Hotspur, so that it is not observable; the armour on these latter parts varies from 14 inches to 12 inches. In one sense she was not a success; it was hoped that she would prove a sufficiently good seaboat to be able to accompany the fleet. This it was thought she was not, while her deep draft of over 22 feet does not improve her use for coast defence; she, however, proved successful in another respect. When subjected to the trial of the Hotspur she came victoriously out of it. One shot struck the turret on the weakest spot, yet failed to prevent it working, let alone penetrating it. About the same time the Cyclops, Gorgon, Hecate, and Hydra were built.

They were each 3400 displacement instead of 5000 like the Glatton, drew only 15 feet of water, had eight inches of armour instead of 12 inches, and can only go 10 knots instead of 12. They have two turrets, each containing two 10-inch M.L.R. guns. They are all four yet in the service. The flying deck is of much smaller extent than in the Glatton, and is confined to the space between the turrets, some 45 feet.

While these last ships were being tried the Devastation was being built, and was from time to time being altered; the loss of the Captain also influenced this. Thus the abandonment of sails was approved. It was pointed out that twin screws vitally affect this. As finally altered, her improvements over the Glatton were the following: the armoured breastwork did not extend the full breadth of the ship, this allowed an unarmoured superstructure to be carried round the ship to the height of the upper deck of the breastwork. This greatly increases the accommodation of the crew. The armament was four 35-ton guns (now 10-inch B.L.) She can steam 6000 knots at 10 knot speed,

while her speed is 13·84 knots. She proved undoubtedly a success; for after a long trial, she and her sister ship, the Thunderer, have amply proved themselves good sea boats. Before dismissing them I may remark that they cannot be mistaken from any of the mastless ships yet mentioned from their having two funnels, and from their superior size and a fighting top on their military mast.

The Dreadnought, the next of this type, is an improved Thunderer. The armoured breastwork extends against the sides. She is 35 feet longer, while the armoured belt extends the whole length of the ship at the same height above the water-line, while in the other two it diminishes considerably towards the bow. The lower edge of the armour is carried downwards in the stem both to strengthen it and to afford a better resistance to a raking fire. Her armour, too, is nearly two inches thicker (14 inches), where the Devastation has only 12 inches. The only way I can point, to distinguish her from the two older vessels, is that her bow is a good deal higher. In fact, almost worthy of the word forecastle. I may remark in passing, that the need of being able to tell one ship from another, and to know something of her structure, was well illustrated this morning. At early drill the Thunderer was lying at anchor some 1000 yards from our battery. She naturally formed the target laid on. After some little deliberation it was naturally agreed that with the 80-prs. we were using the fighting top would be the only part we could annoy her in. A 9-inch M.L.R. near might have been used to attempt to damage her magazine, one of the officers saying he knew where it was placed. Now the highly important fact of her having an unarmoured superstructure round her citadel or breastwork was unknown to the battery, the destruction of this, even with light guns, was certain; and, as Lord Brassey avers, with a disturbed sea a serious loss of stability might occur. Now in this case the papers had informed us it was the Thunderer, in war one would want to know whether it might not be the Dreadnought, for if so a hopeless task might be attempted.

While the Dreadnought was being tried, the Brazilian turret-ship, Independencia, was bought, and re-named the Neptune. I have already mentioned her as being the only vessel in our service that could reasonably be mistaken for the Monarch; of which, though built 10 years later she is an improved type. Her length is, it is true, 30 feet less, but her beam is five feet six inches greater, giving her 9300 tons displacement to 8300; while her armour is 12 inches as compared with seven inches, that on the turrets being 13 inches in place of 10 inches. The height of the freeboard of the armoured redoubt or breastwork is only 11 feet in place of 14 feet, as in the Monarch, but it has been observed that the greater beam seems to ensure for this fully-masted ship a sufficient stability. She has been called by some a "masted Devastation," but the description is not, I think, a good one. In one thing she somewhat resembles that ship, and that is in the form of her flying deck, which is much shorter than in the Monarch, leaving the fore turret in the open. This makes a ready means of separating her from the Monarch, though she has two funnels instead of one. Her weak points are that her engines are only covered with 12 inches of

armour, and she can only steam 1480 knots at 10 knot speed. The latter fault could, however, be easily remedied by new engines. Her speed at present is 14 knots.

The foregoing ships of the turret class are all more or less from designs of Sir Edward Reed. We now come to those of Mr. Barnaby. The first of these is the Inflexible. This ship is far more like the Italian Duilio than her predecessor in our service, with whom, however, we will compare her. In the first place the turrets are placed out of the line of keel, the bow one on the port side, the other on the starboard. This enables the whole of her four guns to be discharged simultaneously right-ahead or astern. In consequence of this it was found practicable to place them too much nearer to one another, thereby reducing the armoured breastwork to 110 inches in length instead of 184 inches in the Dreadnought, and 156 inches in the Devastation. It extends across the deck as in the former of these vessels. Another point gained by the side mounting of the turrets was that it enabled masts to be used without interfering with direct fire ahead. Accordingly she was rigged as a brig, a narrow upper deck being erected along her length to work her sails; the funnels being placed at each end of her citadel. As it was intended to give her armour from 24 inches to 17 inches it became necessary to confine its use to the centre of the ship. The belt on the water-line was given up; this was compensated for by a large number of water-tight compartments, a belt of cork where the armour would have gone, and a thin shot-proof deck. The cork chambers have, since her first commission, been increased. In addition to this she has a number of water-tight tanks. The idea, of course, is that if a shot hit the unarmoured ends at right angles it would travel through four feet of cork, then two feet of canvas and oakum, then such coal and stores as were unconsumed, and were in the water-tight tanks, and then through cork and oakum again to the sea. As regards size, she was the same length as the Dreadnought, 11 feet more beam, with a tonnage of 11,900 instead of 10,800 tons displacement. For armament she has four 80-ton guns instead of the same number of 38.

I forgot to mention that the Inflexible is classed as a mastless ship, as in time of war it is intended to remove the top-masts and topgallant-masts, and use the lower masts simply as military masts or signal poles. She is not fitted with bowsprit or head sails. About her has raged a furious fight on the question whether the destruction of her unarmoured ends would destroy her stability. After much discussion, a strong Committee was appointed to consider this point, and it decided in the negative. The reason her funnels are placed so far apart is that she was the first and, I think, the only armoured ship in our service with the stoke-holes placed at both ends of the engine-room.

The conclusion arrived at, by the above-named Committee, carried such weight that it was decided to accept the Inflexible as the type of the future British line-of-battle ship. Accordingly the Ajax and Agamemnon were built, differing from that ship in dimensions, but not in type. They have each 40 inches less length and 14 feet less beam.

The citadel being only 104 feet instead of 110 feet. The deduction in tonnage being nearly 3000 tons. The cork is carried further fore and aft. Their armament is 38-ton guns in place of 80-ton. They are easily distinguished from their larger predecessor by only having one funnel placed in the centre of the citadel. Their maximum of armour is 18 inches.

Having proved successful, these two vessels were followed by the Colossus and Edinburgh. Of the same size, and carrying guns of much the same weight but improved type—12-inch B.L.—they are able to steam continuously 6200 knots to the 4100 of the Ajax and her sister, and a maximum of speed of 15·5 knots in place of 13·25; partly due to improved engines, and partly to an increase of length brought about by steel being used for their construction. Their is no particular reason in discriminating between these last four ships. Against them all the object to secure is a hot shell fire. Their sandwich-backed plates would be wisely in most cases left alone.

It is necessary now to make a digression and allude to two families of ships that have sprung from the mastless turret-ships.

One has already been spoken of, the British turret-ram Hotspur. In 1874 she was followed by the Rupert, a vessel that we have up to the present taken no account of. The light upper works are the same in both ships, but a hurricane deck was erected abaft the turret in the later boat, while the turret was made to revolve, and the armoured breastwork was not extended across the deck. The broadside of the ship is protected with heavy armour plates; above the water-line and on the turret they are 12 inches thick. Her engines have lately been renewed propelling her 13·5 knots, while she now carries in her turret two 9·2-inch guns. But her chief weapon for attack and defence is her ram, which projects some nine or 10 feet from the bow. Having only one turret, which cannot fire astern, she is provided with two recessed ports for stern fire, and these serve to distinguish her.

In 1882 she was followed by the Conqueror, and in 1887 by the Hero, two sister ships. The first of these was built as an improved Rupert, of steel, 6200 tons displacement instead of 5500; 20 feet longer and five feet more beam. The citadel or breastwork again extends across the deck, but it is no longer rectangular, its corners being rounded off. It only encloses the turret, conning tower, and funnel. It is protected by 12 inches to 15 inches of steel-faced iron, and is covered by a deck nearly two inches thick of steel. The armour belt on the rest of the ship varies from 11 to eight inches. Between the turret and the chimney is the conning tower, from which to the stern is an upper deck. She has two recessed stern ports. The *Times* says of her:—

> "The leading features of this ship may be said to be, first, that the protection of her vital parts against an enemy's projectiles is so ample, that if the stern and upper works and even the citadel should be damaged, stability would be still preserved; second, that the unarmoured structure, rising high above the submerged vessel, affords comfortable quarters and removes the objections raised against low freeboard monitors. Altogether, the 'Conqueror is the

> best specimen of a single turret-ship yet laid down.' Perhaps the principal, if not the only, objection which may be urged against her, will be her large size and cost, considering that she carries but two heavy guns, and that they have not an all-round fire."

These guns are two B.L. 45-ton guns. Her coal endurance[1] is 5200 knots; her maximum speed 15·5 knots.

The Hero is a similar vessel in every way.

The other digression concerns barbette ships. It was gradually being more and more recognised that as armour increased it was impossible to defend the whole ship's sides, and that one would have to be satisfied by protecting the middle of the ship, machinery, &c. France gave early expression to this, by laying down barbette ships; Italy followed. We should doubtless have done the same had not the controversy raised over the turret ships with their only partly defended ends prevented us. In July, 1880, however, the first mastless barbette ship built for the British Navy was begun, and named the Collingwood. She proved the first of the Admiral class, the others being the Rodney, Howe, Camperdown, and Anson. To give them speed the length was increased, that of the Camperdown being 325 feet. Her beam is 68 feet and her displacement 9500 tons. The turrets, which in all barbette ships are open, are pear-shaped in plan, and do not revolve. The guns are placed on a revolving table. The armour of the sides of the ship extend to about the middle line of the turrets, an iron bulkhead connecting the two. The conning tower is placed just aft of the fore turret, then come the two funnels, then two steam pinnaces (on the upper deck) and then the after turret. A steel deck, curved as usual, runs the entire length of the ship. The armament in general is four 67-ton B.L. guns in the barbettes, and six 6-inch in the secondary battery on the main deck between the turrets. The armour consists of 18 inches on the sides; 16 inches on the bulkheads, and from 14 inches to 12 inches on the barbettes. The weak point of the Admiral class is undoubtedly the slight protection afforded to the gun-crews working the guns in the secondary battery, but their high speed atones in many persons eyes for this, and also for their low freeboard forward.

Their open turrets at once separate them from ordinary turret-ships, as their big guns stand out clear and plain. Four of them at present are in the Channel Squadron; and they have acquitted themselves well in the late Autumn Manœuvres. There is a strong resemblance in this class to the Conqueror, of which ship some have considered they are only an improved type.

While the Admiral class have been building, another somewhat similar ship was proceeded with, the Benbow. She is the same length, but was designed for two 110-ton B.L. guns, one in each barbette. She also carries a larger central battery, viz., 10 6-inch guns. This has entailed her size being increased to 10,600 tons displacement. The barbettes, like in the rest of the Admiral class, are placed in the

[1] In speaking of coal endurance, I invariably mean at 10 knot speed.

line of keel, but are polygonal in plan instead of circular, or rather pear-shaped.

The success of these ships have led to an improved type, that of the Royal Sovereign class, including, besides that ship, the Ramilies, Empress of India, Repulse, Resolution, Revenge, and Royal Oak.

These ships are 380 feet long in place of 325 feet; their beam being at the same time increased to 75 feet from 68 feet, and their total displacement rising from 10,300 tons to 14,150. Their maximum speed has been increased from 16·75 to 17·5, though their coal endurance at 10 knot speed falls from 8500 knots to 5000. The armament is the same, four 67-ton B.L. guns, except that in place of six 6-inch Q.F. they mount in all 10 of these weapons with a larger number of smaller guns. In fact it is doubtless the need of being able to deliver a rapid fire against small craft, that brought the Admiral class and then the Royal Sovereign into existence. The following disposition of armament was laid down:—

"1. That there should be four heavy guns placed in two protected stations situated at a considerable distance apart, each pair of guns having an arc of training of about 260° equally divided on each side of the line of keel. All four of these guns to be available on each broadside.

2. That the greater portion of the auxiliary or secondary armament should be placed in a long central battery situated between the two heavy gun stations, and so disposed that there should be practically no interference with the fire of any one gun by that of any other.

3. That in view of the development of high explosives, it was desirable to secure the widest possible distribution of the guns in the auxiliary armament; and that it was preferable to mount the auxiliary armament on two decks, one of them being the spar deck, rather than to carry the guns chiefly between decks."

Hence we find the barbettes are about 225 feet apart instead of about 160 feet, while four of the 6-inch are on the main deck and six on the upper, the corner guns of these being able to fire directly fore and aft.

With regard to armour, the belt has been extended to two-thirds of the ships length, thus reaching to the outer edge of the barbettes, across which they extend in athwart ship bulkheads. Above the belt, which is 18 inches, is armour of five inches, which protects the secondary battery on the main deck. A 3-inch steel deck runs the entire length of the ship, fitting along the top of the belt. The turrets are protected by 17 inches, and enclose not merely the turret bases, but also the upper portion of the ammunition hoists and loading appliances. They will be easily marked from the Admiral class.

Turning back now to the turret-ships, an advance on the armament of the Colossus was needed. It was decided to build two ships for two 110-ton B.L. guns, hence the Victoria and Sans Pareil were designed. Having only one turret it had of necessity to be placed in

line with the keel. It was protected with 18 inches of armour and placed on a small redoubt of the same, as this, however, would afford no protection to the engines the belt was extended aft so as to cover nearly half the ship's length. At the same time a 3-inch steel deck covered the entire length. The conning tower is aft of the turret and then come the two funnels placed alongside one another ; an easy way of distinguishing them. Aft of this again is a spar deck that extends to the stern, where to deliver a stern fire is placed a 10-inch 29-ton B.L. gun. This gun is very noticeable. Below the spar deck on the upper deck are placed 10 6-inch guns ; and running athwart the ship, dividing this battery, is a 3-inch screen bulkhead of steel. Outside the battery below the stern chaser are two more 6-inch guns that can also assist in this purpose. The shape of this battery is not rectangular. Its bow end is pointed. A shield of 6-inch armour protects it from end on fire.

Comparing these ships in size with the Colossus, we find they are 20 feet longer, two feet more beam, 1000 tons more displacement, and over a knot faster, while they have a strong secondary armament.

We now come to the Nile and Trafalgar. The 110-ton gun having been discarded for the 67-ton, four guns could be carried instead of two ; hence we see again two turrets. They are designed to meet the objections urged against the Admiral class of alleged insufficient protection and armoured stability, therefore the armoured belt extends to 230 feet out of a total length of 345 feet. The turrets are placed 120 feet apart, and in a central line. They are thus more of an improved Dreadnought than of a Colossus, while they differ from the Admirals not only in the increased depth and longitudinal area of their armour, but in the main armament being in turrets and not in barbettes. Thus the citadel is divided into an upper and lower on which the turrets stand, while between these is a central box battery, as it is termed, in which are eight 4·7-inch Q.F. The armour varies in thickness from 20 inches to 16 inches.

The Hood is a turret-ship with redoubts, and is one of the Royal Sovereign class in size, armament, armour and speed, except that she has turrets instead of barbettes. The result is increased protection, at a cost of carrying her guns six feet lower, and a corresponding loss of freeboard at each end. Like the Sovereign class she has two military masts and funnels placed side by side.

We must now return to the central battery ships, which we left at the completion of the Audacious class.

Owing, it is said, to the battle of Lissa, the Admiralty decided to strengthen the ram and give a more formidable bow fire, With this view the Alexandra was built. Like the preceding class she has a central battery arranged in two tiers ; the lower battery being considerably longer than the upper, the forward ports constructed so as to fire within 3° of the line of keel. The upper battery now possesses two 9·2-inch B.L. guns firing through her bow ports, and two 18-ton M.L.R. guns firing astern, her lower two of the same heavy guns firing through her bow recessed ports, and six 18-ton guns broadside armament ; besides six 4-inch B.L. guns and a number of smaller quick-firers.

Her thickness of armour at the sides was increased from eight inches to 12 inches, but it was no longer of the same depth for the whole length of the ship, thus it was carried down to 12 feet below the water-line so as to impart additional strength to the stem. To protect the stern against a raking fire a traverse bulkhead was constructed, plated with six inches of armour, and extending to a depth of six inches below the water-line. She is full-masted and will steam some 15 knots. The Alexandra has as nearly a perfect all-round fire as a central battery ship can have. She can fire her four heaviest guns almost ahead; while for her broadside fire she has on either side two of these, together with four 18-ton guns, while she can use two of the latter as stern chasers. She is easily distinguished by her high masts and the bow recessed ports (in double tier) of her central battery. It is well to remember that the fore funnel stands outside the upper battery and the aft in its very centre. These batteries are only armoured with eight inches and six inches of iron, so that, though the water-line is well protected, there is much left to fire at even from small guns, especially when it is remembered that the upper battery—whose sides, by-the-bye, do not overhang—has to serve as the conning tower.

The Temeraire quickly followed the Alexandra. She is 1000 tons less in displacement, being 285 feet long only, in place of 325, a foot less in beam, and having 11 inches of armour in place of 12 inches. The feature that distinguishes her fundamentally from other ships is that she carries the upper deck armament in two barbettes, instead of in the central battery. In each of these she has a 25-ton gun, and in her battery, which resembles the lower tier of the Alexandra though smaller, she carries four 10-inch guns, and two 11-inch. These two latter pieces are divided from the other four by a bulkhead somewhat similar to that of the Alexandra, only there it is formed by the walls of the upper battery being carried down through the lower. The Temeraire is probably the easiest ship in our Navy to know, as owing to her barbettes she is rigged as a brig, and, I believe, is the heaviest masted ship we possess. The barbette guns are mounted on disappearing hydraulic carriages.

About the time these ships were being tried, the Superb and the sister ships, Belleisle and Orion were bought by purchase, having been originally built for other Governments.

The first is a full-rigged ship much of the same type as the Hercules, only with a longer central battery. She carries 16 18-ton guns, and six 4-inch B.L. She has recessed ports both fore and aft. The belt varies from 12 inches to seven inches, and is carried down some depth below the water-line, and is raised only a little above what appears to be the main deck, but is in reality only a spar deck of unarmoured timber; it being assumed that in action the crew will be in the armoured enclosure, the unarmoured deck above being left to its fate. The conning tower is formed above the fore bulkhead of the battery. She has two funnels, while the Hercules, Penelope, and Audacious class have but one. The recessed ports, too, also mark the length of her central battery. She might, however, be confused with a few of the cruisers.

The Belleisle is a very much smaller ship, under 5000 tons displacement, in place of over 9000. The belt is 12 inches thick amidships diminishing towards the extremities. The central battery is a raised octagon citadel, mounting four 25-ton guns which fire out of the angles, giving a cross-fire fore and aft within a range of 90 yards. The thickness of the armour of the citadel is from nine to ten inches; it is 60 feet long. The main deck is nearly level with the water, and is protected by three inches of iron. Above is erected a spar or hurricane deck, containing cabins, etc. The idea is that this could be shot away without injury to the citadel or submerged hull.

They have only a speed of about 12 knots, and can be considered as little more than coast defence vessels. The funnel is outside the citadel.

The octagon citadel almost gives them the appearance of a turret. They are rigged as brigantines and should be easily known.

We have now to speak of the armoured cruisers, these till lately hardly formed a class by themselves, as their work was performed by second-class line-of-battle ships, the frigates of old.

The first we may rank as such, is the Shannon. She would have been described when built as a second-class broadside, armour-belted, cruising ship. She is 260 feet, 54 feet beam, and has 5000 tons displacement. She is fully rigged as a ship, and has a single lifting propellor. Sail power was intended to be used under all ordinary conditions of cruising; in fact, she has a coal endurance of only about 2000 knots and cannot make 13 knots an hour.

She is one of the earlier embodiments of attempting to dispense with a certain amount of armour. Thus the belt only extends to within 60 feet of the stem, terminating in an armoured transverse bulkhead. An armoured deck entends from here to the bow, at first horizontally, and then descending to within 10 feet below the water-line. The guns on the broadside are unprotected, and mounted at considerable distances apart. The belt is nine inches thick at its maximum, four feet high above the water, and five feet below. The ram is moveable and is only intended to be fixed in time of war. The armament consists of two 10-inch guns firing out of recessed ports forward, two 9-inch ditto at the stern, and three on either side. They are all placed on the upper deck in the open, except the stern chasers, which are under the poop deck. She has a single funnel. The fact of the armament being on the upper deck should serve to mark her.

The abandonment of bow armour is said to have suggested to Mr. Barnaby the idea in the Nelson and Northampton, of modifying the stern on the same principle. They have an increase of tonnage of over 2200 tons, are 280 feet long, and 60 feet beam. The belt is here only 180 feet long, but is much the same as in the Shannon, being terminated by bulkheads with armoured decks extending to stem and stern. The armament consists of four 10-inch guns for bow and stern, firing out of recessed ports, and eight 9-inch, all on the main deck.

On the upper deck are four 4·7-inch Q.F. and 20 smaller ditto. The oblique armoured bulkheads are extended up to the main deck, so as to protect the four heavy guns, the eight 9-inch have only the ship's thin

sides in front of them. Between each two guns is a thin transverse bulkhead to protect the crews from splinters, they are each one inch thick. They are rigged as ships, but are intended in action only to have the lower masts standing. They have two funnels and can hardly be mistaken for the other two-funneled broadside ships, owing to the long double tier, provided the upper deck armament is discerned. It may be remarked how opposed this style of protection is to that of the Inflexible for instance. The Nelson can steam considerably the better of the two.

A great advance was made with the Imperieuse and Warspite, although at first they had to meet a good deal of hostile criticism. The length is 315 feet, the beam 62 feet, and the tonnage displacement 8400 tons. The maximum speed is nearly 17 knots, and at 10 knot speed they can steam 7000 knots.

They are built of steel, and are copper sheathed. The belt only extends for 140 feet, and is steel-faced 10 inches thick. The armoured deck that meets it fore and aft is of steel three inches thick. The transverse bulkheads are nine inches thick, but do not extend higher than the belt, but a steel deck, half the thickness of that at the ends, runs along the top of the belt forming the lower deck. On the main deck are six 6·6-inch B.L., of which two fire out of recessed ports as either bow or broadside guns. On the upper deck are four 9·2-inch guns. These are in small barbettes, two amidships, and two bow and stern in line with the keel. The conning tower is just abaft the forward barbette. The funnels are fore and aft of the amidship barbettes. There is only a military mast.

These were followed by the belted cruisers, of which we have seven, the Aurora, Australia, Orlando, Narcissus, Galatea, Undaunted, and Immortalité. Their length is 300 feet, beam 56 feet, displacement 5600. Their maximum speed is over 18 knots, with a coal endurance of 8000. Their belt is 10 inches thick, and is met fore and aft by an armoured steel deck three inches thick.

The transverse bulkheads are 16 inches thick, and over them and the belt is a steel deck two inches thick. The armour is, therefore, the same in type as in the preceding class, only that the belt extends to nearly 200 feet in length. On the main deck are 14 quick-firers. On the upper deck there are two 9·2-inch B.L. guns firing from small barbettes as bow and stern chasers. The two broadside guns, however, are here replaced by ten 6·6-inch guns, of which six are broadside weapons only, the remaining four being placed in small towers so as to enable them to fire respectively bow or stern as well. They have two military masts and two funnels, and are easily recognised by the very unusual proximity of the foremast to the bow funnel.

The protected cruisers, though mustering in number close on a hundred, need not detain us long. They are comprised in some six or seven classes, that differ in construction little from one another. The pioneers of the type are the American ships Idaho and Wampanoag, built after the successful careers of the Sumter and Alabama had demonstrated the need of such vessels.

The first British ships thus designed solely for the protection of our

merchant steamers were the Inconstant, Active, and Volage, followed by the Shah, they were officially designated as "iron screw-frigates and corvettes." They were entirely guiltless of armour. The Raleigh and Boadicea followed, and then the Bacchante, Euryalus, Iris, and Mercury. They all looked to protection to numerous water-tight compartments, coupled by the defensive position of their coal bunkers. Thus they all run the risk of being sent to the bottom by a single shell. In view of this the Leander class were built. With a length of 300 feet and extreme breadth of 46 feet, they have a displacement of 3750 tons. A steel protective deck 1·5 inch thick extends over engines, boilers, and magazines. It is slightly below the water at the middle line, and curved down so as to be four feet below it at the sides. The armament consists of ten 6-inch B.L. guns, and a number of smaller quick-firers, Maxims, etc. Their speed is 17 knots and coal endurance 11,000 knots. They rank as second-class cruisers. Their rig is light, with square yards on their foremasts, and fore and aft sails only on their main and mizen.

They have two funnels, and can hardly be confused with the belted cruisers, which are not rigged, or with the older line-of-battle ships. The large amount of room taken up by engines in itself proves a guide to the newer cruisers. Of this type are the Amphion, Arethusa, Leander and Phaeton.

Of an altogether smaller size, ranking, indeed, as third-class cruisers, is the "C class." They are only 225 feet long, greatest breadth 44 feet, and tonnage displacement 2380. Their maximum speed is about 13 knots and coal endurance 5400, in some cases less. The armour deck is similar to that of the Leander class, but in one curve to the side. They carry when re-armed ten 6-inch B.L., but a smaller number of lighter weapons than the preceding class.

In both cases all the guns are on the upper deck. Of this type we have nine vessels, Comus, Champion, Cleopatra, Conquest, Curacoa, Canada, Carysfort, Constance, and Cordelia.

They are thus well armed, strongly built, protected by a steel deck and coffer dams, with internal bulkheads, but, alas! sadly deficient in speed.

The old gem class were ships of about this size. They have three masts and are fully rigged.

The Calypso and Calliope are well-known ships, and are also of this size. They were completed in 1883 and 1884, and are yet old-fashioned. Their speed is under 14 knots. They are slightly larger than the "C" class.

Smaller than these considerably is another class, that of the Heroine, Hyacinth, Pylades, Rapid, Royalist, and Satellite. They are only 1400 tons displacement, 200 feet long, and 38 feet beam; their speed at their best is only 13 knots, but at 10 knot speed they can steam 6000 knots. Their armament, too, is good, carrying eight 6-inch B.L. guns. These three classes complete the partially-protected cruisers. It will be observed that the Leander ranks as second-class, the Comus as "C," and Heroine as third-class. It seems unlikely that any more will be built.

Coming now to those with fully-protected decks, we will start with the first-class cruisers, though they are the newest.

The bulk belong to the Edgar type, including, besides that craft, the Royal Arthur, Crescent, Endymion, Gibraltar, Grafton, Hawke, St. George, and Theseus. Their length is 360 feet, breadth 60 feet, displacement over 7500 tons. It is hoped they will steam 20 knots, and have a coal endurance of 10,000 knots at half that speed. They will carry the same armament as the belted Aurora class, viz., two 9·2-inch mounted as bow and stern chasers, and ten 6-inch ; only that here, instead of all the guns being carried in the open on the upper deck, four will be placed on the main deck, in armoured towers. They have two funnels, but these are placed further aft than in the Aurora type, where, as I pointed out, one is only just abaft the fore jurymast. They have no fighting tops, another distinguishing mark.

Their steel deck varies from five inches in thickness and curves down well below the water at the sides, and stem and stern. Much discussion has been raised about the wisdom of giving them 22-ton guns, which may lead to their doing what they should never undertake, namely, engaging an armoured battle ship. They may be remembered as enlarged Merseys and diminished Blakes.

This latter ship, with the Blenheim, is very similar, only that the length is 375 feet, breadth 65 feet, and tonnage displacement 9000 tons. They carry the same armament in the same way. The steel deck is three inches on the level and six inches on the slope. The top rises to 18 inches above the water-line, and slopes down to 6·5 feet below it at the sides. I suspect only practice would enable one to know them from the Edgar type, unless it is the fact that their funnels are more raking. They have enough coal to steam at 10 knots for 15,000 knots.

Coming to the second-class cruisers, we find the Mersey type as the largest. They comprise the Mersey, Severn, Forth, and Thames. They are 300 feet long, with a beam of 46 feet, and a displacement of 4000 tons, and a speed of 18 knots.

They can steam at 10 knots nearly 9000 knots. They are armed as the preceding vessels, only with all their armament on the upper deck, 8-inch guns being substituted for the 9·2-inch, and the 10 6-inch being, of course, much closer crowded together. They have only one funnel, and carry no sails, and have two fighting tops. Their steel deck, two inches and three inches, offers no peculiarity.

Next to these come the new Apollo type or improved Medeas. They are the same length, but three feet less beam and only 3600 tons displacement. They are thus the same size as the Leander class. They carry a lighter armament than the Mersey's, 6-inch being substituted for the 8-inch, and six 4·7-inch for the 10 6-inch, but on the other hand they have a larger number of lighter guns. They have a speed of 20 knots, and a coal endurance of 8000. The steel deck extends throughout, and is one inch on the level and two inches on the slope. They have two funnels, and low masts in one piece, with fore and aft sails. They comprise the Aeolus, Andromache, Apollo, Astrea, Bonaventure, Brilliant, Cambrian, Intrepid, Indefatigable, Iphigenia,

Melampus, Naiad, Pique, Rainbow, Retribution, Latona, Sappho, Scylla, Sirius, Spartan, Sybille, Terpsichore, Thetis, and Tribune. Like the rest of the new cruisers they have no fighting tops.

The Medea type, from which the Apollo's were evolved, comprise the Magicienne, Marathon, Medea, Medusa, and Melpomene. They are only 265 feet in length, beam 41 feet, and tonnage 2800. They, too, have a speed of 20 and a coal endurance of 8000 knots. They carry six B.L. 6-inch guns, of which only two are broadside guns, fired out of small circular projections from the deck. The bow and stern guns, which are mounted on the forecastle and poop, are not in the line of keel, but in the same overhanging towers as the broadside weapons. They are rigged in the manner described for the Apollo type, but have fighting tops, if one can so call them, half-way up the fore and main masts. They have a 6-pr. mounted right astern, which is very noticeable. They proved far too cramped, hence the Apollo type.

Another type is that built for the Australian Colonies, the Katoomba, Mildura, Wallaroo, Tauranga, and Ringarooma, they are improved Archers, and before Colonial names were given were known as the Pandora type. They are 265 feet long, 41 feet in breadth, and 2900 tons displacement, running 19 knots, with a coal endurance of 4800 knots. The armament consists of eight 4·7-inch guns, two being on the forecastle, two on the poop, and two each on the port and starboard sides on the upper deck. These guns, which form the main armament of so many of the smaller cruisers, it must be remembered, penetrate 10 inches of wrought iron, and fire 10 shots per minute. In addition to these there are the usual smaller pieces. They are rigged as the Apollo type. Of the same class are the Pallas, Pearl, Philomel, and Phœbe.

This completes the second-class cruisers.

The third-class comprise but one type of two dimensions. The Barracouta, Barrosa, Blanche, and Blonde, are only 1580 tons, 220 feet long and 35 feet beam. They carry six 4·7-inch Q.F., four 3-prs., and two Maxims, with a speed of 16·5 knots and a coal endurance of 3400. Similar with them are the Barham and Bellona, 1830 tons a speed of three more knots.

We have now only to name three other ships and we have completed the armoured and protected ships of our Navy. The Polyphemus is the sole representative at present of a torpedo ram. She carries only six 6-prs. Q.F., and in section is not unlike that of an onion. Her keel is one of her peculiarities, it being only a recess. She is really a floating cylinder. The other two are the Hecla and Vulcan. Being Torpedo ships neither are likely to come into a conflict with forts.

In the above, it will be observed I have said little or nothing about firing at, or hitting any of the above; in the first place much will have to be discussed with reference to this when we deal with foreign ships, and in the next to shorten space it seemed better to defer this—the crux of the whole to then.

I have also left out of account torpedoes as not being an Artillery subject.

List of works consulted :—

1. "Our Ironclad Ships." By Sir E. J. Reed, K.C.B.
2. "The War-ships and Navies of the World." By J. W. King.
3. "The British Navy." By Lord Brassey.
4. "The Naval Annual." By Lord Brassey.
5. *The Times, Broad Arrow, etc*

GIBRALTAR,
15th June, 1891.

EXTRACTS

FROM THE

REPORT OF THE ORDNANCE COMMITTEE ON EXPERIMENTS WITH SIEGE MATERIAL CARRIED ON AT LYDD IN 1890.

COMPILED UNDER THE DIRECTION OF

COLONEL E. LYONS, R.A.

(Camp Commandant, Lydd).

THE programme was intended to determine the following points amongst others :—

Series (*B.*)—The effect of high angle fire from, and accuracy of, the 6·3-in. R.M.L. howitzer of 18 cwt., bored up to 6·6-in., and rifled with a pitch of one turn in 15 calibres, firing shells of large capacity, to be carried out on the Twydall casemates.

This experiment was fired on the 11th October, the shells were of forged steel (for use with high explosives), and were of two lengths, viz., four and five calibres. Their estimated weights were 99 lbs. 2 ozs., and 120 lbs. 12 ozs. when filled with gun-cotton.

Only three of the 5-calibre shell were fired, of which two turned over in flight; the practice was, therefore, stopped.

Of the 4-calibre shell, three cast steel, filled with salt, were first fired with good results. This practice was, however, of no assistance with regard to the forged steel shell, as they were nearly 15 per cent. heavier than the latter.

Five rounds were then fired with cast copper gas-checks with serrations on their inner rims, which were intended to engage in projections on the base of the shell, but they failed so to act, and the practice was very irregular.

Gas-checks of the service pattern were next tried, and 16 rounds fired, but showed little improvement; one hit, however, was obtained.

Six rounds were fired with cast copper gas-checks similar to those used for the first five rounds, but nicked on the base of the shell before loading. These also gave very poor results.

The conditions of the practice, inasmuch as the elevation and deflection were continually altered with the object of hitting the target, prevent any exact estimate of the accuracy of the 4-calibre shell, but it is obvious that little dependence is to be at present placed on them.

The irregularity of the practice may be due to the varying weight of

the shell (from 100·5 to 104 lbs.) or to some defects in the fitting of the gas-checks.

Only one round hit the casemate; it made a considerable crater, but did no damage to the interior.

Series (*C.*)—To ascertain the comparative efficiency of the 8-in. R.M.L. and B.L. howitzers in breaching a concealed revetment.

Fired on the 16th and 17th August. Target: A row of nine feet targets placed behind a covering mass of shingle; an angle of descent of 25 degrees was necessary for a projectile to clear the covering mass and hit the targets. Range: 2000 yards. Charges: M.L. 4½ lbs. R.L.G.[2]; B.L. 6 lbs. R.L.G.[4] Projectiles: Common shell, filled with salt, and plugged.

Thirty rounds were fired from each of the howitzers, with the result that only two direct hits were obtained, both from the B.L. howitzer. One round, also from the B.L. howitzer, may, however, be perhaps fairly counted as a hit, since it struck and tore away one of the supports from which it glanced through the bottom of the target.

This practice, though fair, gives no data from which to estimate the efficiency of the R.M.L. howitzer against such a target, since no hits were obtained, though 11 rounds were fired at approximately the correct elevation; of the B.L. howitzer it may be said that from 6 to 10 per cent. of the rounds may be expected to hit under the given conditions.

The B.L. howitzer undoubtedly showed itself to be the more accurate of the two when fired at a high angle with a low charge; its shell was much more steady in flight than that of the R.M.L. howitzer.

It is evident, however, that, under the most favourable conditions, the amount of time and ammunition required to breach a revetment so covered would be excessive, even if it be accepted that every hit will produce its full effect. On the other hand in this experiment the effect of bursting shell in lowering the covering mass was not allowed for.

Remarks on Material.

The carriage of the B.L. howitzer is very easy to traverse and elevate, but difficult to load. No ordinary detachment could work a B.L. howitzer on its present carriage for a siege relief unless some special loading gear was available.

In order to obtain full cover from the parapet, the piece must remain elevated, in which case to constantly put in and ram home a shell is the work of three or four men. Should cover be sacrificed and the piece be brought horizontal before loading the height of the breech is considerable, and the arrangement of the transoms and of the bottom plate of the carriage makes it difficult for men to stand close enough to the breech to enter the shell into the bore.

Series (*E.*)—This was a trial of the comparative efficiency of the experimental siege mountings supplied by Sir W. Armstrong, Mitchell & Co., and by Messrs. Easton and Anderson respectively, for the 3·5 ton "wire" and 5 ton "blow-out" 6-in. B.L. guns.

These mountings were designed to fire over a parapet of about nine

feet six inches in height, the gun recoiling into the loading position and being elevated into the firing position by means of hydro-pneumatic rams, etc., forming part of the carriage.

The target in this series was a typical Siege Battery, the crest being taken as the datum point for the measurement of hits.

The range was about 3000 yards. 100 rounds were fired from each gun; 50 from each mounting.

The results were as follows:—

ELSWICK MOUNTING.

6-inch "wire."	49 rounds.	Mean error	15·7 yards.	Hits 24.
" "blow-out."	48 "	" "	31·2 "	" 18.

EASTON AND ANDERSON MOUNTING.

6-inch "wire."	43 rounds.	Mean error	26·4 yards.	Hits 10.
" "blow-out."	48 "	" "	14·4 "	" 27.

These results are very contradictory, since the wire gun appears to shoot best on the Elswick mounting, and the blow-out gun on the other. This may probably be due to the fact that the "wire" is lighter than the "blow-out" gun, and thus moves more on the less steady mounting. Practice against such a target is not, however, a very good test of absolute accuracy, and this experiment was rather intended to try the handiness and serviceability of the mountings.

In these respects, as also in handiness, the Elswick mounting appears to be much superior to the other, as it is steadier, more regular in recoil, can be more accurately traversed and elevated, and is more easily taken to pieces and put together; the Elswick mounting is, however, by far the heavier.

Advantage was taken of this practice to test the effect of thin (4·5 inches) iron plates, laid on the exterior slope, in deflecting shell which would otherwise have injured the parapet; in this, as was to be expected, they were successful.

No difficulty whatever was experienced in assembling or dismantling the "blow-out" gun.

Series (*G.*)—To ascertain the effect of oblique howitzer fire on steel palisades in the ditch of the Twydall redoubt or similar work.

Forty rounds of filled common shell were fired from two 8-in. R.M.L. howitzers at a range of about 2600 yards, the line of fire was at an angle of 30 degrees to the line of palisades (which thus offered a target 30 feet by 10 feet); the angle of descent was 13 degrees.

One howitzer (the 8-in. R.M.L.) was laid for direction with French's sights and for elevation with the clinometer, the other both for elevation and direction with Scott's sight, laying back on an auxiliary mark in rear.

The practice was good, but a little short, the mean point of impact was minus eight yards, due to one howitzer having insufficient elevation.

Nine shell, or 22·5 per cent., injured the palisades, of these three rounds passed through it without bursting, two hit it with splinters, and four burst under it.

The palisade was wrecked and rendered useless as an obstacle, but

the very large craters made by the shell in the stiff clay soil would, in practice, have proved almost as great a hindrance to an assaulting party as the palisade itself.

The fact that such shell as directly hit the palisade passed through without bursting proves that it would be useless to attack such an obstacle except with oblique fire; while it is evident that, in the case of a deep ditch, or a short flank, it might be necessary to considerably increase the angle of descent, which would probably diminish the accuracy of the practice.

The first 20 shell were fired with D.A. fuzes Mark III.; all but one, which was unsteady in flight, burst on first graze. These 20 shell were intended to be burst close up to the foot of the palisade. The remaining 20 were fired with the small percussion fuze Mark II., and intended to burst on the palisade.

As a whole the experiment is instructive, showing that such a palisade, though difficult to breach on account of its combination of passive strength with a small area of rigid resistance, can, under exceptionally favourable circumstances of observation of fire, be destroyed as an obstacle with a medium expenditure of time and ammunition.

It should, however, be borne in mind that this practice was regulated by the communication of the position of each round to the battery; while on service, on the contrary, the observation of fire on such a target would be exceedingly difficult.

Series (*H.*)—To test the efficiency for siege purposes of the 4-in. and 5-in. B.L. guns on lattice-girder carriages.

This series was divided under two heads, viz. :—

1. Fire with percussion shrapnel on dummies in a hasty field redoubt.

Thirty rounds were fired from the 4-in. B.L. and 30 from the 5-in. B.L. at a range of 2500 yards, but the results were poor. The former making 29 hits, the latter only 15. The superior slope of the parapet was rather steep, and shell falling on it appeared to be smothered, only those that struck close to the crest giving any results.

From this practice, as a whole, it may be gathered that the fire with percussion shrapnel from high velocity guns at troops behind a parapet, at such ranges as give a low angle of descent would, therefore, be under service conditions, a mere waste of ammunition.

2. Fire of common shell from 4-in. and 5-in. B.L. guns with the object of breaching a typical siege 30 feet parapet.

Fifty common shell were fired from the 4-in. B.L. at a range of 2500 yards, of these 18 or 36 per cent. hit the parapet, which was not breached, or even seriously injured.

From the 5-in. B.L. 50 common shell were also fired, of these 30 or 60 per cent. hit the work.

The parapet, though seriously injured, was not breached. This effect might, however, have been produced in the course of another 30 rounds.

The superior accuracy and power of the 5-in. as compared with the 4-in. B.L. gun was very marked; since, while the latter failed to produce any damage to the parapet which might not be repaired in a few

minutes, the effect of the former was such that a continuance of its fire would have thrown open the interior of the work within a very short time. It is, at the same time, a matter for consideration whether, except under peculiar circumstances (such as the presence at a given spot of a disappearing gun), the mere breaching of a parapet at one place is worth the expenditure of 80 rounds of 50-lb. shell.

Attention having been called to the fact that any gun emplacements which might be in rear of such a parapet would have been rendered quite untenable by (presumably) a comparatively small number of shell burst in and on the parapet, since the splinters of the common shell were observed in this practice to exercise destructive effect within the work, further experiments were carried out as follows—

Series (*O.*)—A trial of the effect of common shell on men and material behind parapets of various profiles.

This practice was carried out against two targets, parapets of medium earth, of which the profiles were suggested by Major Savage, R.E.

(1.) Target : parapet 15 feet thick at top ; superior slope $\frac{1}{5}$; exterior slope $\frac{1}{4}$.

Twenty dummies were placed close to the interior slope of the parapet, a row of six-feet targets stood four yards, and a row of nine-feet targets 24 feet in rear.

Fifteen rounds of common shell (eight cast-iron and seven forged-steel, Mark IV.), at 1200 yards, were fired from the 5-in. B.L.R. gun, and fifteen rounds of common shell (seven cast-iron and eight forged-steel), at 2500 yards.

The dummies received 46 hits, while both rows of targets were riddled.

It is evident that a parapet of this profile and thickness affords no protection to troops standing in rear against the shells of a 5-in. B.L. gun, but, on the contrary, tends rather to assist the effect of fire, as it enables the shell to be burst at an effective distance.

(2.) Fire with the 20-pr. B.L. and the 12-pr. B.L. guns against a parapet 15 feet thick at top, having a superior slope and an exterior slope as above.

N.B.—Owing, it is presumed to an error, this parapet was made 15 feet thick in place of nine feet, as suggested by Major Savage, R.E.

The 20-pr. B.L. gun fired 15 rounds of forged-steel common shell, at ranges of 1200 and 2500 yards.

Effect—Only four dummies were hit ; the damage done to the row of nine-feet targets was caused by three shells which burst on the row of six-feet targets, and should not, therefore, be taken into account.

These guns were evidently unequal to their task. It is a matter of opinion how far this failure is due to the (unintended) thickness of the parapet, and how far to the fact that forged-steel common shell are not suited to guns of such small calibre, since, as is noticed by the Experimental Officer, such shell break up into a few large pieces, and, therefore, produce little effect.

Series (*I.*)—A further test of the value of the observation and cor-

rection of fire with the aid of balloons, as compared with the theodolite system.

In a series of 190 rounds recorded by the Experimental Officer, the mean error with the theodolite system was 6·25 yards in range, and 3·2 feet in line. 103 or 54 per cent. of the errors in range were under five yards, and 149 or 78 per cent. were under 10 yards. In 160 or 84 per cent. of the observations, the error as regards line was under five feet.

It was evident that the system of observation by means of a pair of theodolites is more accurate than the system of observation from a balloon. This was, indeed, to be expected, since in the latter case the observer, though well situated as regards his field of view, has only his own estimate of distance to guide him in his report, whereas the theodolite measures instrumentally the position of the burst of the shell.

Again, the balloon can be used only in still weather. It is, moreover, probable that on service a balloon would be compelled to remain at a greater distance from the enemy than was the case at Lydd.

It is advisable, however, that the observation of fire from a balloon should still form a part of the programme for the practice at Lydd, since the introduction of smokeless powder will render impossible the system at present adopted, of deciding as to the position of the enemy by taking the bearings of the smoke of his guns! Such a proceeding would even now be fallacious in the case when the enemy fired with howitzers from hollow ground, especially if the smoke drifted to one or the other flank.

Series (*M.*)—A comparative trial of French's and Scott's sights for laying back, after four comparative trials of these sights made during service practice, it was found that the use of French's sights, with a clinometer, gave the best results.

A further trial with R.M.L. howitzers (*Series G.*) showed that the rectangle of the howitzer with which Scott's sight was used, was worse by 10 yards than that of the other, which was laid with French's sights and a clinometer.

Additional trials with the 4-in. B.L. gun and with the 7-in. and 8-in. B.L. howitzers showed that Scott's sight was much effected by mirage, while the small amount of deflection which can be given on it renders it unsuitable for use with howitzers. This defect might, however, be remedied in a later pattern.

Other objections to Scott's sight are urged, for example:—

1. Its peculiarities render it unsuited to any but exceptional layers.

2. The laying back mark, when it is used, must be at some little distance from the gun; while French's sights with the clinometer are independent of any such consideration.

3. As designed it is better adapted to laying forward than to laying back (for which purpose it has to be reversed), while laying back is universal with siege howitzers and frequent with siege guns. It is, moreover, doubtful whether, taking the short radius of Scott's sight into consideration, that instrument is as accurate as French's sights in

laying for line, while the automatic correction of deflection for difference of level of wheels is not so necessary with siege as with field guns, since with the former, which fire from a platform, this correction is practically constant so long as the direction of fire remains unaltered.

Under these circumstances it appears that French's sights, with a good clinometer, are much simpler in use than Scott's sight and give at least equally accurate results.

It will, therefore, be advisable to use French's sights and the clinometer exclusively for all R.M.L. howitzers; since, however, these sights cannot be conveniently employed with B.L. howitzers, on account of the shape of the piece, it will probably be necessary to improve the Scott's sight in the direction suggested above.

Series (*N.*)—To test the value of theodolite observation of fire by night.

In this series 10 rounds were fired by night on four occasions, under different atmospheric conditions varying from bright moonlight to a dark and stormy sky. The average error of the whole series was seven yards in range and 5·5 feet in line, which is about the same as would be the case by day.

As might be expected, the errors tend to increase in bad weather or exceptional darkness.

So far as this experiment goes, the results are very satisfactory; since they tend to show that theodolite observation is as trustworthy by night as by day. The Committee, however, consider that the experience at present obtained is not sufficient to enable them to form a decided opinion on this point, and they, therefore, propose to carry out further trials in this direction.

Amongst other experiments the service platform laid horizontal was tried and gave good results.

This system would be advantageous in the case of R.M.L. guns and howitzers, of which the recoil is useful as affording facility for loading, pieces are easier to lay upon them than on sloping platforms, and they do not necessitate any allowance for difference of level of wheels when the line of fire is not normal to the crest of the parapet. For B.L. guns and howitzers they are not desirable, since it is advantageous that these shall run up after firing, while the tendency to lift the front of the platform, due to the position of the pivot (which is more marked with B.L. than with R.M.L. guns, etc.), may in time result in a reverse slope of the platform which would be very objectionable.

It would, therefore, appear to be desirable that platforms for R.M.L. guns should be laid horizontal, and those for B.L. guns with a slope to the front.

The general behaviour of the service platform, when laid on earth, was so satisfactory that the only desirable modification would appear to be in the direction of some arrangement for holding down the front when used with high velocity guns.

The experimental guns and howitzers used in 1890 were :—

1. The 6-in. B.L. 3·5 ton wire gun.

The shooting of this gun was very satisfactory, but the combination

of its small weight with the heavy charge (40 lbs. E X E) makes it very lively. It also heats very much when fired.

2. The 6-in. B.L. gun of five tons, blow-out construction.

This gun also shoots very well, but it is by no means easy to take to take to pieces or to put together.

The Experimental Officer reported that he found no difficulty in doing this at Lydd, but the operation has not always been equally satisfactory elsewhere. It is, however, unlikely that it will need to be frequently carried out on service.

3. 6·6-in. R.M.L. howitzer, bored up from 6·3-in.

The shooting of this howitzer with shell of four or five calibres in length was not good, but it is hoped that further experience will render it possible to overcome this defect, at least as far as the shorter pattern of shell is concerned.

COMPARATIVE TRIAL OF STEEL-BODIED SHRAPNEL, WITH BURSTERS IN THE HEAD AND BASE RESPECTIVELY, CARRIED OUT AT SHOEBURYNESS IN 1882-3.

BY

LIEUT.-COLONEL E. BAINBRIDGE, R.A.

In 1882 designs of steel shrapnel shell having the bursting charge in the head instead of in the base were put forward, and experiments were instituted to determine the comparative efficiency of these shell and those having bursters in the base.

These experiments were of a very exhaustive nature, embracing shell for all calibres of B.L. guns from 6-inch to 12-prs. The result of these trials shewed that for 6-inch guns and upwards the shells with bursters in the base had the advantage, owing to the comparatively large bursting charge which had to be employed for shells with bursters in the head. In the 5-inch calibre the advantage was doubtful, but with the 4-inch and 12-pr. the advantage was decidedly in favour of the shells with the bursters in the head, and they were in 1883 adopted into the service.

The action of the shell is as follows. The base is attached to the body by weak rivets. The small bursting charge acting on the head causes a retardation of the bullets sufficient to break the rivets joining the base and body. The body, proceeding with undiminished velocity, passes over the bullets leaving them unconfined.

The greater efficiency of this nature of shell as a time shell appears to be due to the larger number of bullets it contains, there being no central channel. Its greater efficiency as a percussion shrapnel is due to the fuze being close to the bursting charge. There is no delay in the burst of the shell after the action of the fuze, and there is no time for *ricochet* before the burst takes place.

From the 12-pr. gun several designs of each nature of shell were tried, and ultimately a shell with burster in the head, Elswick design, E.[2] and a shell with burster in the base, Royal Laboratory design R.L.[5] were selected for final trial. The following is an abstract of the results :—12-pr. B.L. gun ; charge 4 lbs. S.P. ; weight of shell, 12½ lbs. Design E.[2], with burster in the head ; 216 bullets, 34 to the lb. ; burster ¾ oz.

Design R.L.[5], with burster in base ; 136 bullets, 34 to the lb. ; burster 1⅛ oz.

Targets 9 feet × 9 feet × 2 inches; 12 targets in each of 2 rows; rows 50 yards apart.

Nature of shell.	Range to 1st row.	Number of rounds.	Distance of burst from 1st row.	Total hits.§	Hits per round.	Total disabled on 1st row.		Remarks.
						Cavalry.	Infantry	
	Yards.		Yards.					
E.[2] ...	1500	7	100	662	94·6	219	217	Shells burst on 2″ wooden screen 100 yards from 1st row of targets.
R.L.[5]...	"	7	"	503	72	146	163	
E.[2] ...	2000	4	"	369	92·2	126	142	
R.L.[5]...	"	4	"	299	75	94	96	
E.[2] ...	"	7	Varied from 15 to 75 yds.	634	90·6	97	126	Shells burst on graze in front of 1st row.
R.L.[5]...	"	7	from 15 to 84.	181	26	35	35	
E.[2] ...	2500	5	25 to 60.	409	82	76	88	
R.L.[5]...	"	5	25 to 63.	56	11·2	21	18	
E.[2] ..	3000	5	¶	248	49	56*	59*	
R.L.[5]...	"	5	†	112	22·4	38*	36*	
E.[2] ...	3500	9	‖	226	25	46*	46*	
R.L.[5]...	"	7	‡	199	28·4	29*	31*	

* When shells passed over 1st row the number disabled on 2nd row are given.
§ Not counting strikes.
¶ Varied from 53 short of 1st row to 25 short of 2nd row.
† Varied from 87 short of 1st row to 13 short of 2nd row.
‖ Varied from 100 yards short of 1st row to 13 yards from 2nd row.
‡ Varied from 90 yards short of 1st row to 22 yards from 2nd row.

THE

CANTOR LECTURE, 1890—WILLIAM STURGEON.

COMMUNICATED BY

MAJOR R. H. MURDOCH, R.A.

U.S. PATENT OFFICE

In No. 6, Vol. XIII. (1884) will be found a Memoir of William Sturgeon, ex-gunner and driver of the Royal Artillery, inventor of the electro-magnet, lecturer in science and philosophy, at the (late H.E.I. Company's) Military College, Addiscombe,[1] and Director of the Royal Victoria Gallery of Practical Science, Manchester. The *data* then available were, however, only sufficient to furnish an outline of the career and discoveries of this distinguished Artillery scientist; but the name and fame of William Sturgeon have recently been prominently brought before the scientific world through the medium of the Cantor lecture, 1890, on the "Electro-Magnet," delivered before the Society of Arts by Dr. Silvanus Thompson, F.R.S., and the brief regimental memoir (above-mentioned) can now be amplified in the larger light thrown on Sturgeon's labours by the Cantor lecture, for which purpose the editor of the *English Mechanic and World of Science* has kindly lent the writer, for the present purpose, the blocks made use of by that journal to illustrate the models employed by Dr. Silvanus Thompson, extract from whose lecture is given below:—

The Lecture.

Amongst the great inventions which have originated in the lecture-room of the Society of Arts are two of special interest to electricians—

(1) The application of gutta-percha for the purpose of submarine telegraph cables.

(2) The electro-magnet.

This latter invention was first publicly described from the very platform on which I stand, on May 23rd, 1825, by William Sturgeon, whose paper is to be found in the forty-third volume of the "Transactions of the Society of Arts." *For this invention we may rightfully claim the very highest place.*

[1] The Royal Military College at Addiscombe, near Croydon, was for over 40 years the Military College of the Hon. East India Company, where were trained all the Artillery and Engineers and a large proportion of the Cavalry and Infantry Officers who helped to found and consolidate our great Empire in the East. The college was done away with some 30 years since, as the necessary result of the amalgamation of the Queen's and the local Indian forces.

"Peregrine Poulteney" (authorship of which is credited to Sir John Kaye), and "In the Company's Service," describe Addiscombe life in terms that would much surprise the modern cadet. Addiscombe survivors will be glad to know that old "Mother Rose" is living. Having lost the pension purchased for her by the cadets, she is now an inmate of St. Mary's Hospital (Almshouses), Wallington, Croydon. (September 1891).

Electrical engineering, the latest and most vigorous offshoot of applied science, embraces many branches. The dynamo for generating electric currents, the motor for transforming their energy back into work, the arc lamp, the electric bell, the telephone, the recent electro-magnetic machinery for coal mining, for the separation of ore, and many other electro-mechanical contrivances, come within the purview of the electrical engineer.

In every one of these, and in many more of the useful applications of electricity, the central organ is the electro-magnet. By means of this simple and familiar contrivance—an iron core surrounded by a copper wire coil—mechanical actions are produced at will, at a distance under control, by the agency of electric currents. These mechanical actions are known to vary with the mass, form, and quality of the iron core, the quantity and disposition of the copper wire wound upon it, the quantity of the electric current circulating around it, the form, quality, and distance of the iron armature upon which it acts. But the laws which govern the mechanical action in relation to these various matters are by no means well known, and, indeed, several of them have long been a matter of dispute. Gradually, however, that which has been vague and indeterminate becomes clear and precise. The laws of the steady circulation of electric currents, at one time altogether obscure, were cleared up by the discovery of the famous law of Ohm.[1] Their extension to the case of rapidly interrupted currents,[2] such as are used in telegraphic working, was discovered by Helmholtz; whilst to Maxwell is due their further extension to alternating, or, as they are sometimes called, undulatory currents. All this was purely electric work. But the law of the electro-magnet was still undiscovered; the magnetic part of the problem was still buried in obscurity.

Gradually, however, new light dawned. It became customary, in spite of the mathematicians, to regard the magnetism of a magnet as something that traverses or circulates around a definite path, flowing more freely through such substances as iron than through other relatively non-magnetic materials. Analogies between the flow of electricity in an electrically-conducting circuit, and the passage of magnetic lines of force through circuits possessing magnetic conductivity, forced themselves upon the minds of experimenters, and compelled a mode of thought quite other than the previously accepted. So far back as 1821, Cumming experimented on magnetic conductivity. The idea of a magnetic circuit was more or less familiar to Ritchie, Sturgeon, Dove, Dub, and De La Rive, the last-named of whom explicitly uses the phrase, "a closed magnetic circuit." Joule found the maximum power of an electro-magnet to be proportional to "the least sectional area of the entire magnetic circuit," and he considered the resistance to induction as proportional to the length of the magnetic circuit. Indeed, there are to be found scattered in Joule's writings on the subject of magnetism some five or six sentences, which, if collected

[1] *Namely, that the current through a given conductor is proportional to the force that drives it, or that the opposition force exerted by a conductor upon a current is simply proportional to the strength of that current: or, quite briefly, a current through a given conductor is proportional to the E.M.F. which drives it.*

[2] This expression must not be taken as implying that Ohm's law (which is true only of steady currents) is applicable to currents that are not steady.

together, constitute a very full statement of the whole matter. Faraday considered that he had proved that each demagnetic line of force constitutes a closed curve; that the path of these closed curves depended on the magnetic conductivity of the masses disposed in proximity; that the lines of magnetic force were strictly analogous to the lines of electric flow in an electric circuit. He spoke of a magnet surrounded by air being like unto a voltaic battery immersed in water or other electrolyte. He even saw the existence of a power, analogous to that of electro-motive force in electric circuits, though the name, "magneto-motive force," is of more recent origin. The notion of magnetic conductivity is to be found in Maxwell's great treatise (vol. II., p. 51), but is only briefly mentioned.

In recent years the notion of the magnetic circuit has been vigorously taken up by the designers of dynamo-machines, who, indeed, base the calculation of their designs upon this all-important principle. Having this, they need no laws of inverse squares of distances, no magnetic moments, none of the elaborate expressions for surface distribution of magnetism, none of the ancient paraphernalia of the last century. The simple law of the magnetic circuit and a knowledge of the properties of iron are practically all they need. About four years ago much was done by Mr. Gisbert Kapp and by Drs. J. and E. Hopkinson in the application of these considerations to the design of dynamo-machines, which previously had been a matter of empirical practice. To this end the formulæ of Professor Forbes for calculating magnetic leakage, and the researches of Professors Ayrton and Perry on magnetic shunts, contributed a not unimportant share. As the result of the advances made at that time, the subject of dynamo design was reduced to an exact science.

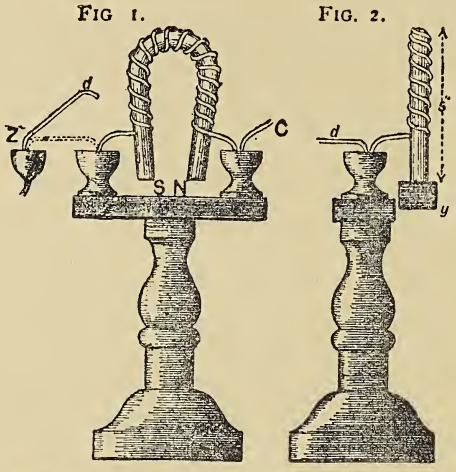
It is the aim and object of the present course of lectures to show how the same considerations which have been applied with such great success to the subject of the design of dynamo-electric machines may be applied to the study of the electro-magnet.

Historical Sketch.

The effect which an electric current, flowing in a wire, can exercise upon a neighbouring compass needle was discovered by Oersted in 1820. This first announcement of the possession of magnetic properties by an electric current was followed speedily by the researches of Ampere, Arago, Davy, and by the devices of several other experimenters, including De La Rive's floating battery and coil, Schweigger's multiplier, Cumming's galvanometer, Faraday's apparatus for rotation of a permanent magnet, Marsh's vibrating pendulum,[1] and Barlow's rotating star-wheel. But it was not until 1825 that the electro-magnet was invented. Davey had, indeed, in 1821, surrounded with temporary coils of wire the steel needles upon which he was experimenting, and had shown that the flow of electricity around the coil could confer magnetic power upon the steel needles. But from this experiment it

[1] In the original memoir, already quoted, I described Marsh as "the Arsenal chemist." Professor Peter Barlow was, however, the Arsenal chemist, and Marsh was Barlow's assistant. In March 1822 (*Philosophical Magazine*) Professor Barlow described his own star wheel electro-motor, and mentioned Marsh very favourably—crediting him with original work, and regretting that "Marsh was not in a position where his great abilities would receive higher pecuniary recognition." *(sic.)*

was a grand step forward to the discovery that a core of soft iron, surrounded by its own appropriate coil of copper, could be made to act not only as a powerful magnet, but as a magnet whose power could be turned on or off at will, could be augmented to any desired degree, and could be set into action and controlled from a practically unlimited distance.



Figs. 1 and 2.—Sturgeon's First Electro-Magnet.

The electro-magnet, in the form which can first claim recognition for these qualities, was devised by William Sturgeon, and is described by him in the paper which he contributed to the "Proceedings" of the Society of Arts in 1825, accompanying a set of improved apparatus for electro-magnetic experiments. The Society of Arts rewarded Sturgeon's labours by awarding him the silver medal of the Society and a premium of thirty guineas. Amongst this set of apparatus are two electro-magnets, one of horse-shoe shape (Figs. 1 and 2), and one a straight bar (Fig. 3). It will be seen that the former figures represent

Fig. 3.

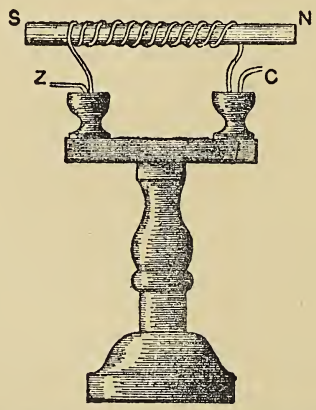


Fig. 3.—Sturgeon's Straight-bar Electro-Magnet.

an electro-magnet consisting of a bent iron rod about one foot long and half inch in diameter, varnished over and then coiled with a single left-handed spiral of stout uncovered copper wire of 18 turns. This coil was found appropriate to the particular battery which Sturgeon preferred—namely, a single cell containing a spirally enrolled pair of zinc and copper plates of large area (about 130 square inches) immersed in acid; which cell, having small internal resistance, would yield a large quantity of current when connected to a circuit of small resistance. The ends of the copper wire were brought out sideways and bent down so as to dip into two deep connecting cups, marked Z and C, fixed upon a wooden stand. These cups, which were of wood, served as supports to hold up the electro-magnet, and having mercury in them served also to make good electrical connection. In Fig. 2 the magnet is seen sideways, supporting a bar of iron, *y*. The circuit was completed to the battery through a connecting wire *d*, which could be lifted out of the cup Z, so breaking circuit when desired, and allowing the weight to drop. Sturgeon added in his explanatory remarks that the poles N and S of the magnet will be reversed if you wrap the copper wire about the rod as a right-handed screw instead of à left-handed one, or, more simply, by reversing the connections with the battery, by causing the wire that dips into the Z cup to dip into the C cup, and *vice versa*. This electro-magnet was capable of supporting 9 lbs. when thus excited.

Fig. 3 shows another arrangement to fit on the same stand. This arrangement communicates magnetism to hardened steel bars as soon as they are put in, and renders soft iron within it magnetic during the time of action; it only differs from Figs. 1 and 2 in being straight, and thereby allows the steel or iron bars to slide in and out.

For this piece of apparatus and other adjuncts accompanying it, all of which are described in the Society's "Transactions" for 1825, Sturgeon, as already stated, was awarded the Society's silver medal and a premium of thirty guineas. The apparatus was deposited in the museum of the Society, which therefore might be supposed to be the proud possessor of the first electro-magnet ever constructed. Alas! for the vanity of human affairs, the Society's museum of apparatus has long been dispersed, this priceless relic having been either made over to the now defunct Patent Office Museum, or otherwise lost sight of.[1]

* * * * * * * * * * *

Sturgeon's first electro-magnet, the core of which, weighing about 7 ozs., was able to sustain a load of 9 lbs., or about 20 times its own weight. At the time it was considered a truly remarkable performance. Its single layer of stout copper wire was well adapted to the battery employed, a single cell of Sturgeon's own particular construction, having a surface of 130 square inches, and therefore of small internal resistance. Subsequently, in the hands of Joule, the same electro-magnet sustained a load of 50 lbs., or about 114 times its own weight.

[1] Alas! also that the volumes of his "Annals of Electricity"—the monument of industry, which Sturgeon presented to the Artillery N.C.O.'s library—were sold, as out of date, in 1884, prior to my memoir of Sturgeon being published in the R.A.I. "Proceedings."

There is, however, at Manchester, (discovered by Professor Silvanus Thompson), a fine portrait, in oils, of William Sturgeon, which (or a copy of it) the Royal Artillery ought to possess?

Sturgeon's further work during the next three years is best described in his own words :—"It does not appear that any very extensive experiments were attempted to improve the lifting power of electro-magnets from the time that my experiments were published in the 'Transactions of the Society of Arts, &c.,' for 1825, till the latter part of 1828. Mr. Watkins, philosophical instrument maker, Charing Cross, had, however, made them of much larger size than any which I had employed, but I am not aware to what extent he pursued the experiment. In the year 1828, Professor Moll, of Utrecht, being on a visit to London, purchased of Mr. Watkins an electro-magnet weighing about 5 lbs.—at that time, I believe, the largest which had been made. It was of round iron, about 1 inch in diameter, and furnished with a single copper wire twisted round it 83 times. When this magnet was excited by a large galvanic surface, it supported about 75 lbs. Professor Moll afterwards prepared another electro-magnet, which, when bent, was 12½ inches high, 2½ inches in diameter, and weighed about 26 lbs. ; prepared like the former with a single, spiral conducting wire. With an acting galvanic surface of 11 square feet, this magnet would support 154 lbs., but would not lift an anvil which weighed 200 lbs."

At the date of Sturgeon's work the laws governing the flow of electric currents in wires were still obscure. Ohm's epoch making enunciation of the law of the electric circuit appeared in "Poggendorff's Annalen" in the very year of Sturgeon's discovery, 1825, though his complete book appeared only in 1827, and his work, translated by Dr. Francis into English, only appeared (in Taylor's "Scientific Memoirs," Vol. II.) in 1841. Without the guidance of Ohm's law it was not strange that even the most able experimenters should not understand the relations between battery and circuit which would give them the best effects. These had to be found by the painful method of trial and failure. Pre-eminent amongst those who tried was Professor Joseph Henry, then of the Albany Institute, in New York, later of Princeton, New Jersey, who succeeded in effecting an important improvement. In 1828, led on by a study of the "multiplier" (or galvanometer), he proposed to apply to electro-magnetic apparatus the device of winding them with a spiral coil of wire "closely turned on itself," the wire being of copper from $\frac{1}{40}$th to $\frac{1}{25}$th of an inch in diameter, covered with silk. In 1831 he thus describes the results of his experiments :—

"A round piece of iron, about ¼ inch in diameter, was bent into the usual form of a horse-shoe, and instead of loosely coiling around it a few feet of wire, as is usually described, it was tightly wound with 35 feet of wire, covered with silk, so as to form about 400 turns ; a pair of small galvanic plates, which could be dipped into a tumbler of diluted acid, was soldered to the ends of the wire, and the whole mounted on a stand. With these small plates the horse-shoe became much more powerfully magnetic than another of the same size, and wound in the same manner, by the application of a battery composed of 28 plates of copper and zinc, each 8 inches square. Another convenient form of this apparatus was contrived by winding a straight bar of iron, 9 inches long, with 35 feet of wire, and supporting it horizontally on a small cup of copper containing a cylinder of zinc—

when this cup, which served the double purpose of a stand and the galvanic element, was filled with dilute acid, the bar became a portable electro-magnet. These articles were exhibited to the Institute in March, 1829. The idea afterwards occured to me that a sufficient quantity of galvanism was furnished by the two small plates to develop, by means of the coil, a much greater magnetic power in a larger piece of iron. To test this, a cylindrical bar of iron, $\frac{1}{2}$ inch in diameter, and about 10 inches long, was bent into the shape of a horse-shoe, and wound with 30 feet of wire; with a pair of plates containing only $2\frac{1}{2}$ square inches of zinc, it lifted 15 lbs. avoirdupois. At the same time, a very material improvement in the formation of the coil suggested itself to me on reading a more detailed account of Prof. Schweigger's galvanometer, and which was also tested with complete success upon the same horse-shoe; it consisted in using several strands of wire, each covered with silk, instead of one. Agreeably to this construction, a second wire, of the same length as the first, was wound over it, and the ends soldered to the zinc and copper in such manner that the galvanic current might circulate in the same direction in both, or, in other words, that the two wires might act as one; the effect by this addition was doubled, as the horse-shoe, with the same plates before used, now supported 28 lbs. With a pair of plates 4 inches by 6 inches it lifted 39 lbs., or more than fifty times its own weight. These experiments conclusively proved that a great development of magnetism could be effected by a very small galvanic element, and also that the power of the coil was materially increased by multiplying the number of wires without increasing the number of each."

Not content with these results, Professor Henry pushed forward on the line he had thus struck out. He was keenly desirous to ascertain how large a magnetic force he could produce when using only currents of such a degree of smallness as could be transmitted through the comparatively thin copper wires, such as bell-hangers use. During the year 1830 he made great progress in this direction.

In *Silliman's Journal* (April, 1831), Professor Henry gave "an account of a large electro-magnet, made for the laboratory of Yale College." The core of the armature weighed $59\frac{1}{2}$ lbs., it was forged under Henry's own direction, and wound by Dr. Ten Eyck. This magnet, wound with 26 strands of copper bell-wire of total length of 728 feet, and excited by two cells which exposed nearly $4\frac{7}{9}$ square feet of surface, readily supported on its armature, which weighed 23 lbs., a load of 2,063 lbs.

Writing in 1867 of his earlier experiments, Henry speaks thus of his ideas respecting the use of additional coils on the magnet and the increase of battery power:—

"To test these principles on a larger scale, an experimental magnet was constructed. In this a number of compound helices was placed on the same bar, their ends left projecting, and so numbered that they could all be united into one long helix, or variously combined in sets of lesser length.

From a series of experiments with this and other magnets, it was proved that in order to produce the greatest amount of magnetism from

a battery of a single cup, a number of helices is required; but when a compound battery is used, then one long wire must be employed, making many turns around the iron, the length of wire and consequently the number of turns being commensurate with the projectile power of the battery."

Henry, sums up his own position as follows:—"(1). Previous to my investigations the means of developing magnetism in soft iron were imperfectly understood, and the electro-magnet which then existed was inapplicable to transmissions of power to a distance. (2). I was the first to prove by actual experiment that in order to develop magnetic power at a distance, a galvanic battery of 'intensity' must be employed to project the current through the long conductor, and that a magnet surrounded by many turns of one long wire must be used to receive this current. (3). I was the first to actually magnetise a piece of iron at a distance, and to call attention to the fact of the applicability of my experiments to the telegraph. (4). I was the first to actually sound a bell at a distance by means of the electro-magnet. (5). The principles I had developed were applied by Dr. Gale to render Morse's machine effective at a distance."

Though Henry's researches were published in 1831, they were for some years almost unknown in Europe. Until April, 1837, when Henry himself visited Wheatstone at his laboratory at King's College, the latter did not know how to construct an electro-magnet that could be worked through a long wire circuit. Cooke, who became the coadjutor of Wheatstone, had originally come to him to consult him, in February, 1837, about his telegraph and alarum, the electro-magnets of which, though they worked well on short circuits, refused to work when placed in circuit with even a single mile of wire. Wheatstone's own account of the matter is extremely explicit:—"Relying on my former experience, I at once told Mr. Cooke that his plan would not and could not act as a telegraph, because sufficient attractive power could not be imparted to an electro-magnet interposed in a long circuit; and to convince him of the truth of this assertion, I invited him to King's College to see the repetition of the experiments on which my conclusion was founded. He came, and after seeing a variety of voltaic magnets, which even with powerful batteries exhibited only slight adhesive attraction, he expressed his disappointment."

After Henry's visit to Wheatstone, the latter altered his tone. He had been using *faute de mieux*, relay circuits to work the electro-magnets of his alarum in a short circuit with a local battery. "These short circuits," he writes, "have lost nearly all their importance, and are scarcely worth contending about since *my discovery*" (the italics are our own) "that electro-magnets may be so constructed as to produce the required effects by means of the direct current, even in very long circuits."

We pass on to the researches of the distinguished physicist of Manchester, whose decease we have lately had to deplore, Mr. J. P. Joule, who, fired by the work of Sturgeon, made most valuable contributions to the subject. Most of these were published either in Sturgeon's "Annals of Electricity," or in the "Proceedings" of the

Literary and Philosophical Society of Manchester, but their most accessible form is the re-published volume issued five years ago by the Physical Society of London.

In August, 1840, he wrote to the "Annals of Electricity" on electro-magnetic forces, dealing chiefly with some special electro-magnets for traction. Both the magnet and the iron keeper were furnished with eye-holes for the purpose of suspension and measurement of the force requisite to detach the keeper.

His experiments were followed by some to ascertain the effect of the length of the iron of the magnet, which he considered, at least in those cases where the degree of magnetisation is considerably below the point of saturation, to offer a decidedly proportional resistance to magnetisation; a view, the justice of which is now, after fifty years, amply confirmed.

In November of the same year further experiments in the same direction were published. A tube of iron, spirally made and welded, was prepared, planed down as in the preceding case, and fitted to a similarly prepared armature. The hollow cylinder thus formed was 2 feet in length, in internal diameter was 1·42 inches, its internal being 0·5 inch. The least sectional area was $10\frac{1}{4}$ square inches. The exciting coil consisted of a single copper rod, covered with tape, bent into a sort of S-shape. This was later replaced by a coil of 21 copper wires, each 1-25 inches in diameter and 23 feet long, bound together by cotton tape. This magnet, excited by a battery of 16 of Sturgeon's cast-iron cells, each 1 foot square and $1\frac{1}{2}$ inch in interior width, arranged in a series of four, gave a lifting power of 2775 lbs.

Joule's work was well worthy of the master (Sturgeon) from whom he had learned his first lesson in electro-magnetism. He showed his devotion not only by writing descriptions of them for Sturgeon's "Annals," but by exhibiting two of his electro-magnets at the Victoria Gallery of Practical Science, of which Sturgeon was director. Others, stimulated into activity by Joule's example, proposed new forms, amongst them being two Manchester gentlemen, Mr. Radford and Mr. Richard Roberts, the latter being a well-known engineer and inventor. Mr. Radford's electro-magnet consisted of a flat iron disc, with deep spiral grooves cut in its face, in which were laid the insulated copper wires. The armature consisted of a plain iron disc of similar size. This form is described in Vol. IV. of Sturgeon's "Annals." Mr. Roberts's form of electro-magnet consisted of a rectangular iron block, having straight parallel groves cut across its face. This was described in Vol. VI. of Sturgeon's "Annals," page 166. Its face was $6\frac{5}{8}$ inches square, and its thickness $2\frac{7}{16}$ inches. It weighed, with the conducting wire, 35 lbs.; and the armature, of the same size and $1\frac{1}{2}$ inches thick, weighed 23 lbs. The load sustained by this magnet was no less than 2950 lbs. Roberts inferred that a magnet, if made of equal thickness, but 5 feet square, would sustain 100 tons weight. Some of Roberts's apparatus is still preserved in the Museum of Peel Park, Manchester.

On page 431 of the same volume of the "Annals," Joule described yet another form of electro-magnet, but which, in actual fact, was built up of 24 separate flat pieces of iron bolted to a circular brass ring.

The armature was a similar structure, but not wound with iron. The iron of the magnet weighed 7 lbs., and that of the armature 4·55 lbs. The weight was 2710 lbs., when excited by 16 of Sturgeon's cast-iron cells.

In a subsequent paper on the calorific effects of magneto-electricity, published in 1843, Joule described another form of electro-magnet of horse-shoe shape, made from a piece of boiler-plate. This was not intended to give great lifting power, and was used as the field-magnet of a motor. In 1852, another powerful electro-magnet of horse-shoe form, somewhat similar to the preceding, was constructed by Joule for experiment. He came to the conclusion that, owing to magnetic saturation setting in, it was improbable that any force of electric current could give a magnetic attraction greater than 200 lbs. per square inch. "That is, the greatest weight which could be lifted by an electro-magnet formed of a bar of iron one inch square, bent into a semicircular shape, would not exceed 400 lbs."

With the researches of Joule may be said to end the first stage of development. The notion of the magnetic circuit which had thus guided Joule's work did not commend itself at that time to the professors of physical theories: and the practical men, the telegraph engineers, were for the most part content to work by purely empirical methods. Between the practical man and the theoretical man there was, at least on this topic, a great gulf fixed. The theoretical man, arguing as though magnetism consisted in a surface distribution of polarity, and as though the laws of electro-magnets were like those of steel magnets, laid down rules not applicable to the cases which occur in practice, and which hindered rather than helped progress. The practical man, finding no help from theory, threw it on one side as misleading and useless. It is true that a few workers made careful observations and formulated into rules the results of their investigations. Amongst these, the principal were Ritchie, Robinson, Muller, Dub, Von Kolke, and Du Moncel; but their work was little known beyond the pages of the scientific journals wherein their results were described. Some of these results will be examined in my later lectures, but they cannot be discussed in this historical *résumé*, which is accordingly closed.

THE CONCENTRATION OF FIRE FROM FORTS.

BY

LIEUTENANT G. TYACKE, R.A.

In the present system of fighting a fort by Position-Finder, all the guns of a group are laid for direction on parallel lines by means of the arcs on the gun-floor. Consequently the front over which their fire is distributed at all ranges is equal to the distance between the flank guns, and supposing the objective to be a ship lying end-on to the battery, the fire of these flank guns might certainly be wasted, as might even be the case if she were lying broadside-on.

To secure the advantages afforded by the dispersion of guns then, parallel fire must be given up and some plan for the concentration of fire adopted.

It seems to me that this could be done more or less effectively in three ways :—

1. At the Position-Finding instrument, which would then communicate to the training dials the corrected reading required to make the lines of fire of the group cross at the range for which the guns are laid. I cannot say if this be practicable or not. It would involve training dials for every gun.
2. At the guns, by permanently fixing the training pointers of the flank guns of a group so that their lines of fire cross at a point, say at 2500 yards range.
3. At the guns, by having the training pointer capable of lateral movement on the gun-slide in connection with a deflection scale.

It is for the Position-Finding specialist to say if 1 is practicable, but it must necessarily add to the complication of mechanism which is already intricate.

The method set forth in 2 would only correct exactly for the particular range for which the pointers were fixed. If a medium range be taken as the point at which the lines of fire shall cross, these lines at double that range will be no further apart than if the guns were laid parallel, and at all intermediate ranges they will be close together. *See* Figs. (*a*) and (*b*).

FIG. (*a*.)

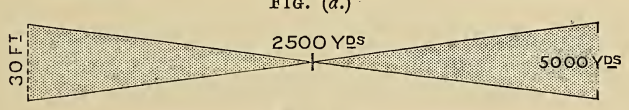
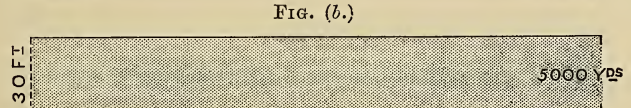


FIG. (*b*.)



Both in 2 and 3 there would be a directing gun for each group, with reference to which the deflection of the other guns would be given by their training pointers, but while in 2 it would be a permanent deflection and only suitable for one range, in 3 the pointer could be adjusted for every range, or as often as is considered necessary.

I would have the deflection scale in 3 graduated in *yards* to correspond with the ranges for which deflection is given; and, as deflection will always be given in the same direction, the pointer should only be capable of sliding *towards* the directing gun of its group.

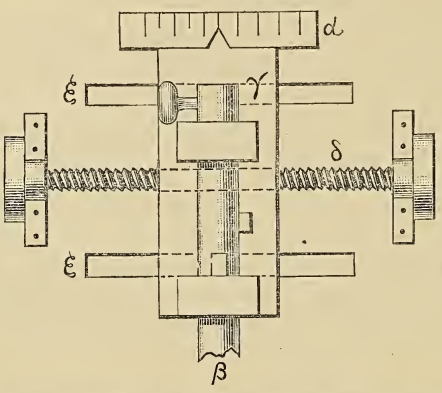
It would be the duty of the gun layer, who knows approximately the range at which his gun is firing, to set the training pointer to that range on the deflection scale before giving the final training to his gun; even if he should forget to attend to this, ranges do not alter so suddenly in action that any great error in direction is to be feared.

A pointer of this description, if desired, could be locked in any position and used as a fixed pointer.

It will be sufficient to graduate the deflection scales for ranges of 1000, 2000, &c. yards, unless the guns are at a considerable interval. Suppose a gun is 30 feet from its directing gun and the radius of its training arc is 15 feet, then the length of deflection scale required to make the two guns converge at 1000 yards works out to $1\frac{1}{2}$ inch, and this would be the maximum needed for the gun in question. For a given radius the length of scale varies directly as, and in proportion to, the interval between guns, and under ordinary conditions it would not exceed 6 inches.

A good method of giving traversing motion to the pointer appears to be that adopted in sights for B.L. guns for moving the deflection leaf. Diagram (*c*.)

DIAGRAM (*c*.)



α = Deflection scale.
β = Training pointer.
γ = Bracket for same with index.
δ = Traversing screw.
ϵ, ϵ = Guide slots for bracket.

In my opinion, if the fire of groups were concentrated on one portion of the objective it would be more effectual both actually and morally, and if any better method of doing it than the above can be devised, I shall be very glad to see it introduced.

SHOEBURYNESS,
October 1891.

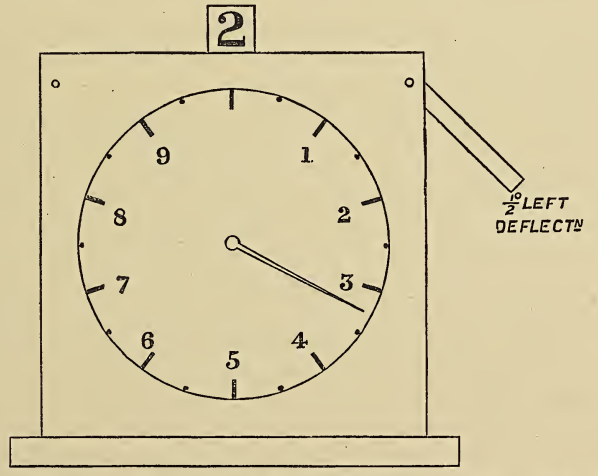
ON THE RANGE INDICATOR DIAL.

BY

LIEUT.-COLONEL R. F. WILLIAMS, R.A.

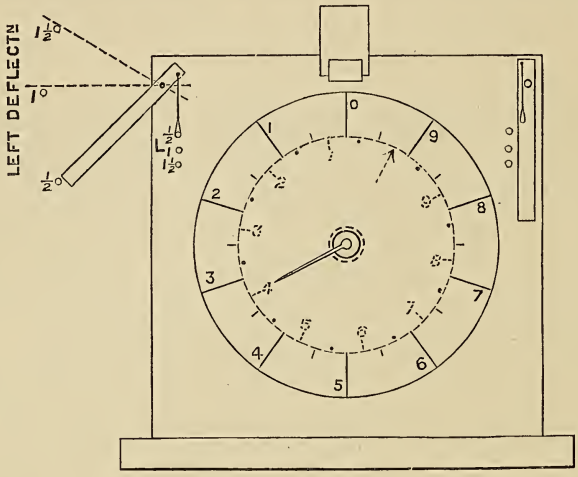
THE range of a moving target is signalled to the guns by means of a Range Indicator Dial in the following way. As the range is called out from time to time, the officer in charge makes the necessary corrections for speed and direction of target, &c. (in fact, all corrections except that for "displacement"), and passes on the corrected range to the Range Dial by which it is signalled to the guns. This officer is, as a rule, the C.O., and his attention is so entirely taken up in correcting the successive ranges as they are called out at every 50 or 25 yards, that he has no time to attend to anything else.

There would probably be no alteration for some considerable time in the amount of correction required, if the course of the target were fairly straight and its speed remained the same. The object then of the contrivance which it is proposed below to apply to the Range Indicator Dial is to relieve the C.O., after he has made the necessary correction in the first instance, from paying any further attention to the matter until, owing to some change in the conditions, a fresh correction should be required. It would further allow of the range being communicated directly from the Range-Finder to the Range Indicator Dial instead of through the medium of an officer as at present, a perceptible saving of time being thereby effected.



The proposed dial would stand upright and have a front and rear face, with 10 divisions on each to mark the hundreds of yards, there

being also intermediate marks to show the fifties. The figures on the front would be covered by the same figures on the back, so that, those on the front being arranged as on a clock face, the figures on the back would, of course, go round the reverse way. (*Vide* fig.) Against the back face would also be placed another smaller or inner dial, similarly divided to the outer one. This inner dial would revolve on an axle



which would be fixed to the centre of the outer dial. It would be necessary to place a thin metal washer between the two dials to enable the inner one to be turned easily. The axle should be hollow, and a pin would pass through it, to each end of which a hand would be rigidly fixed, that which moved on the rear face covering the one on the front so that they would both move together and always point in the same direction.

The changes in the number of thousands of yards would only occur at long intervals, and they might be shown by figures on tin plates placed in a clip at the top of the frame.

Suppose that the C.O. finds, as the result of his corrections, that 75 yards must be deducted from the range found by the Range-Finder before it is signalled to the guns. He orders the man in charge of the Range Indicator Dial to "deduct 75 yards." At this word the inner dial would be turned till the arrow head marking the zero point on it (and which in the first instance corresponded with the zero on the outer dial), was moved 75 yards to the right on the outer dial, as shown in the figure. Every point on the inner dial would then, of course, be 75 yards behind the corresponding point on the outer one. When the range is now called from the Range-Finder the hand is made to point to that range on the inner dial. Say that 2400 is called from the Range-Finder, the figure 2 having been placed in the clip at the top to show the thousands, the hand at the back is made to point to 400 on the inner dial, this corresponds with 325 on the outer dial, and the hand on the front face will therefore also point to 325.

The ranges found by the Range-Finder can then continue to be

marked on the inner dial at once as they are called out, those appearing on the front face being in each case 75 yards less.

Similarly, of course, if it were wished to add to the range found by the Range-Finder, at the word "Add 50 yards" the arrow head would be moved 50 yards in the opposite direction.

It might, perhaps, be necessary to explain to the man in charge of the dial that the figure at the top showing the thousands should always be changed when the hand pointed vertically upwards (*i.e.*, to the zero point on the outer dial and not that on the inner one). It would be unlikely, however, after the first range had been signalled, that any mistake would be made at the guns as to the number of thousands of yards, even if the figure were not changed at exactly the right moment.

The hands might be conveniently turned by a key or by a fixed handle in rear.

In case it might be required at any time to clamp the hand in its position, this might be done by means of a small nut, a thread being cut for it on that part of the pin between the rear hand and the end of the axle.

The present arrangement for showing deflection on the Range Indicator Dial has not been found in practice to be satisfactory. The presence of two hands on the face of the dial, one to show range and the other deflection, although they are of different colours, is objectionable as allowing of the possibility of their being mistaken for each other. Moreover, the two hands being clamped by the same nut in front, whenever this is loosened for the purpose of moving the hand pointing to the range, that showing deflection either falls down or has to be held in its place. It is very difficult, in fact, for one man to manage the two hands at the same time, and in order to do so he must frequently have his hands, if not his whole person, in front of the dial and so obscure it from the guns.

It would be better that the arrangement for showing the deflection should be quite separate from that showing the range. It is proposed that there should be an arm, pivoted near its top end, in rear of each top corner of the frame. (*Vide* fig.) A cord fastened to the top of the arm, and with a loop at its lower end, should be of such a length that when a loop was put over the highest of the three pegs shown on the frame, the arm would be pulled into the position shown as representing half a degree deflection. When the loop was placed on the second peg the arm would be horizontal, which would represent one degree, and when on the lowest peg the arm would be brought into the position represented as showing one and a half degree. The arms on the right and left would show right and left deflection respectively, and it should be made clear that the proper right and left of the dial was referred to, *i.e.*, when looking from the dial towards the guns. When the dial was, as would often be the case, on rising ground in rear of the guns, its right and left would be identical with that of the guns, and the arms would then point in the direction to which deflection was to be given.

NOTE.—The writer wishes to say that when this paper was sent in, in March, he had no knowledge of Captain Elmslie's "corrector" for assisting group officers in giving allowances for "displacement," in which the same method has been adopted for adding and subtracting the allowance.

NOTES OF TWO LECTURES

ON

FIELD FORTIFICATION,

Delivered at the School of Gunnery, Shoeburyness.

BY

MAJOR RABAN, R.E.

Part I.

The art of field fortification, that art by which we hope to enable a force in some way "inferior" to meet successfully a force in some way, whether in numbers, organisation, or arms, "superior" to it, has received its greatest modern development in connection with the preparation of the battle-field. For although the fortification of special features of ground, and of localities, such as woods, villages, country houses or farm buildings, is no new feature in warfare or even in pitched battles, yet field fortification, until recent times, formed no essential feature in battles. So long as the range of fire-arms was comparatively limited, and the stress of their fire so far tolerable that actions could seldom be decided without a resort to the tactics of shock, the greater part of the troops engaged in a battle, not only on the side of the attack, but also on that of the defence, were formed and manœuvred in "dense" formations. Thus the battle of earlier days presents to us an army "drawn up" in regular and solid formations on selected ground, and sometimes, but not by any means invariably, on ground fortified in places, awaiting the attack of an enemy advancing also in regular and solid formations. But as the stress of modern fire has driven us to seek in "dispersed" orders of attack a means of "assembling forward" to within a striking distance, the superior force of the attacker, so on the side of the defence it has forced us to extend our fortification over a large area of the battle-field, in order to afford to the "inferior" force the greatest amount of cover and protection possible.

In tracing the history of this development, it is interesting to note how, in the earlier forms of hasty intrenchments for battle-fields, it was always laid down as an absolutely necessary condition of their design that they should not prevent the advance of troops (including Field Artillery) in formation. Thus, we have our "service" shelter-trench, 1 foot 6 inches in depth (even though it was contemplated to some-

times extend it to the most unnecessary width of 8 feet), with a parapet never exceeding 1 foot 6 inches in height, whatever the width of trench might be, the trench and parapet being separated by a "berm" or step, in order that the rise from the one to the other might not come abruptly. The "German" shelter-trench formed even less of an obstacle and gave somewhat less cover. These hasty intrenchments, though not suited for general use in positions prepared for defence, have still their place in modern field fortification as in the case of works thrown up by the attack, and they may even be still applicable to portions of the battle-field which only need to be lightly occupied, and over which it is contemplated to bring out troops in the counter-attack. But as their construction is a matter of "drill," and as no special Engineer knowledge is required in connection with them, I do not propose to refer to them further: except to state the very important fact, true of them as of all shooting trenches, that proper sites cannot be chosen for them without placing the eye in as nearly as possible the position of the eye of the man who will fire from them. A position that may appear to a man standing, or on horseback, admirably suited for a trench, to sweep the ground in front, may easily be one from which the man *in* the trench can see little or nothing to his immediate front.

Before proceeding to discuss details, I should like to refer briefly to the general principles governing the design and execution of works.

In proportion as field fortification deals with extended areas of the battle-field, and thus with a larger proportion of the "troops," so it becomes the more incumbent on us to make our works meet the "tactical" requirements, though in war, as in everything else, there must be a give and take, a balancing of advantages and disadvantages, and tactics must be adapted to take full advantage of the capabilities of fortification.

I may, perhaps, briefly generalise the tactical requirements by saying that the fortification of a position must be so arranged as not to interfere with the proper control of the troops by the superior commanders, and to afford proper facilities for making such movements in formation as are likely to be necessary.

Bearing in mind these conditions, as limiting and guiding us, I propose now to attempt to deal with some of the "practical" points that arise in the design and construction of "field works."

There are five main practical conditions by which all designs must be governed, viz.:—

1. *By whom the works are to be constructed.*
2. *Against whom the works are to be constructed.*
3. *With what object the works are to be constructed.*
4. *Within what time the works are to be constructed.*
5. *What means and materials are available.*

And I will attempt to deal with these in the order in which I have stated them.

(1.) *By whom the works are to be constructed.*

I am afraid it is often taken for granted that sappers will throw

up the necessary works, because they are accustomed to digging, and so long as fortification was only applied to small isolated portions of a battle-field, this was sometimes possible. But when it is remembered that Engineers only form $\frac{1}{20}$ to $\frac{1}{30}$ of the strength of field armies, and that there are many other special duties they are called upon to perform *which no one else can do* (for want of the necessary technical training), it will at once be seen that it would be quite impossible to attempt any effectual fortification of a battle-field if the labour of Engineers only were to be relied on, or even were to be mainly relied upon, for executing the work. It is quite clear, therefore, that the works must, for the most part, be executed by those troops for whom they are chiefly intended, and who form the bulk of the army, viz., the infantry, aided as far as may be possible by local labour. Engineers must only be looked to, first, to provide the supervision and technical skill (gained by executing works themselves in peace time), which shall enable the infantry to accomplish their work with the least difficulty; and, secondly, to execute themselves any work within the power of their numbers which is particularly difficult or dangerous, or which requires special knowledge.

Bearing in mind the distaste of infantry for this kind of work, and the war conditions under which they will be called upon to do it, such as toilsome marches, possibly indifferent and insufficient food, broken rest, and want of shelter during inclement weather, it must clearly be a "practical" consideration of the utmost importance in designing works that they shall involve the least possible labour that is compatible with their being efficient—that is, that all existing cover which is at all suitable must be utilised to the utmost, and that the construction of entirely new works is only to be undertaken in places where cover does not already exist, or where, from its position or its nature, it cannot be made use of. It should be remembered that, by utilising and improving existing cover, a much less conspicuous line of defence is obtained than where a considerable extent of newly turned-up earth has to be employed: an advantage by no means to be lost sight of.

(2.) *Against whom the works are to be constructed.*

This is of special importance in our service, for while our organisation and training is mainly based on the requirements of a European war, yet our actual war experience is mainly gained in conflicts with enemies ordinarily very warlike, but not highly organised or well armed. Types of works that are well suited for a European battle-field may be very much out of place in "frontier warfare."

The important considerations in this connection are, the weapons we have opposed to us and the kind of attack we have to resist. In our wars, against uncivilised or partially civilised enemies, our tactical practice is generally to attack, and, therefore, "battle-field" defences are not ordinarily required; but as the main difficulty in such warfare is to move and feed large bodies of men, we must expect to be numerically very inferior to our foes: and the defence of camping grounds and of "posts" on the line of communication becomes very important. The condition the works must fulfil in such cases is not so much resistance

to the effect of weapons, as resistance to shock: an obstacle to break the sudden rush of a determined and powerful enemy, and to retain him under fire: an enclosure to contain transport animals, &c., and, if possible, a screen from the view of the enemy, are the chief needs.

Against a civilised foe the use of obstacles is sometimes not so essential, and the "cover" must be designed to resist and protect from the projectiles of the newest weapons.

(3.) *With what object the works are to be constructed.*

This must have a very great influence upon their design: thus, the works constructed in advance of a prepared battle-field, works which it is not intended to hold against a determined attack, but which are merely to be occupied by a comparatively small force long enough to compel the enemy to show his hand and deploy to some extent, should obviously not have the same time and labour spent on them as is spent on works designed to bear the real stress of the battle. Not only would it be discouraging to troops to abandon without determined resistance works on which much labour had been expended, but there would be a danger of the use of the stronger forms of works leading to a prolonged resistance, ending in the battle being fought, not in the carefully prepared position in rear selected for it, but in an advanced and false one.

Again, works well suited for portions of a battle-field over which a counter-attack in force is contemplated would be very ill suited for those strong pivots of the position which are designed to "draw" and resist the main shock of attack.

And, similarly, the type of fortification required for the defence of posts on line of communications, designed to receive and shelter convoys, but to be defended by small permanent garrisons is different from that required on battle-fields.

(4.) *Within what time the works are to be constructed.*

Time imposes this limit on the design of works, that they must either be capable of being completed in the time available, or they must at least be defensible before completion. The difficulty is generally met practically by designing works capable of being executed in a short time, but also capable of being readily modified and improved should more time than was originally expected be available. Here, again, the importance of utilising and improving existing cover, may be noticed, as affording a means of obtaining good protection in a short time.

(5.) *What means and materials are available.*

The utilisation of the means and materials available, to the best purpose, is the highest test of the skill and practical knowledge of the officer charged with the execution of work: over the preceding four conditions he has no control; but had he at disposal such means and materials as he required, his difficulties would not be so great. It is the need of working with what he can find that makes his task a hard one. Not only is there often a great want of suitable materials, but there is often a want of most necessary tools in sufficient quantities. It is with difficulty that modern armies can be moved at all and furnished with

food, ammunition, and other absolutely necessary supplies, and there is little transport for even the most necessary tools. An attempt is made to get over this difficuty to some extent by providing a portable intrenching tool as part of a man's equipment, but it must be borne in mind that these small portable tools, though they are of much value in executing the simpler kinds of hasty intrenchment (particularly because they should always be available for immediate use when required) yet they are from their size not well adapted for heavier work: *i.e*, it is much more difficult for the soldier to get out an ordinary task with his portable tool than with a full sized one.

The difficulty about obtaining "suitable materials" in sufficient quantities is generally met by reverting to "earth," which is fortunately the material best adapted to resist the projectiles of modern weapons, and is, moreover, available in most places. Where other existing forms of cover are not available or require improving, it is therefore usual to resort to earthwork.

Many of the "types" of works given in the text-books show timber and brushwood used in considerable quantities, but much extra labour and many additional tools are required for the preparation of these materials: thus, for example, three men are occupied for between two and three hours in making one gabion (not including the labour of cutting the brushwood), which then occupies two feet lineal of parapet, or less than half of the front of an ordinary task. And this brings us to the question of the dimensions of works. It is often found difficult to remember the dimensions of good types of works: but there are only a very few figures that really need be learnt, and the general design can be worked out from them. Experience teaches us that an average man fires most conveniently over a height of 4 feet 6 inches standing, 3 feet kneeling, and 1 foot 3 inches lying down: it is better to be a little over rather than under the mark, as the task is not always fully completed, soft newly turned earth settles down, and, moreover, if the soldier finds his cover a little too high, he can easily scrape it down for himself in the form of a groove.

Then, again, we find that an average soldier cannot excavate more than about 100 cubic feet of earth at one time, however long he is at work, and that with moderate soil and full-sized tools he can get this quantity out in about 4 hours actual work, provided he has not to go to a greater depth than about 4 feet, or throw the excavated earth more than about 9 feet from him.

As regards arranging men, it is found that they cannot work conveniently and safely with full-sized tools at smaller intervals than 5 feet: they are sometimes placed 4 feet apart, but this is not desirable. A man can more easily get out a solid cube than he can a task involving steps or slopes; these involve extra labour, and either a smaller task or a little more time must be allowed Men should be instructed to work from front to rear of their task, and not across them, as this involves a risk of injuring their neighbours with their tools: this is specially important in night work. It is too often assumed that a man having a full task to do will be provided with a pick and a shovel: but tools must not be expected to be always available in such quantities, and in

moderate soil one pick to two men will be found sufficient. It may sometimes be desirable, when tools are scarce, to have selected men at intervals placed along the line with picks, one to several shovellers, opened rather wider apart than usual. Where men are plentiful and tools scarce it may be desirable, when time is of importance, to double-man each tool; for the infantry soldier, when unaccustomed to digging, cannot work continuously, but takes frequent spells of rest during which his tools are useless. A good arrangement would be to have one man with a pick and another with a shovel to each task.

Where long lines of excavation are necessary and intrenching tools are scarce, much will be gained if one or two ordinary ploughs are taken continually up and down the line; men can even with their hands throw out much of the soil turned over by the plough, and all picking at least is saved. I have seen the excavations for drain pipes got out in this way in America to a depth of at least 2 feet in narrow trenches. The width of the trench would determine the depth to which the ploughs could work. Some ploughs could generally be got.

In field intrenchments it is not usually necessary to move excavated earth further than men can throw it; but this must sometimes be done (as in field redoubts). Wheel-barrows are most desirable for this, where there are no very steep slopes to surmount, but they are seldom available in large numbers. When tools are scarce or shovelling difficult, on account of the soil being wet and sticky, it may sometimes be advisable to adopt the practice of many savage tribes and throw the earth on to some kind of sheet (a hide is a good thing) and draw it along the ground to the required spot and there reverse the sheet.

All tools available in the neighbourhood should be collected and utilised, but, unfortunately, picks and shovels are not "agricultural" tools, and are, therefore, seldom procurable in large quantities.

Details of Cover.

As regards the detail of the cover to be provided, I have already stated that existing cover is first to be utilised to the fullest extent. The defence of walls, hedges, &c., does not involve much difficulty, and, bearing in mind the few dimensions given above, can be readily dealt with; but it is important to realise what does and what does not give sufficient cover. Where bullet proof cover is not available, a mere screen is often most valuable; an enemy does not know when to fire, and has no satisfaction of seeing the effect of his fire; the defenders have also a moral advantage in a sense of security, as is shown by men seeking cover behind mere screens in advancing to attack.

Where cover is not already available, then some form of earthwork is usually constructed: cover is most rapidly and effectually obtained by excavating a trench, as depth below ground and height above, progress simultaneously, to give the necessary shelter; shooting trenches are, therefore, the most usual form of cover for the front line.

The conditions they should fulfil are, I think, as follows:—

They should provide for the men occupying them in comfort, both when firing and when not firing; when firing the man should be able to use his weapon to the best advantage, and I think he does this when standing leaning his weight on a slope, and having a rest for his elbows and his rifle. When not firing he should be able to sit and yet

be thoroughly protected; this means a certain height immediately behind his seat to protect him from long-range rifle-fire and from shrapnel. Our drill-book shows a man lying flat on his face in a two-hour shelter-trench, 8 feet wide and 18 inches deep: the attitude is not convenient for a long period—say, during preliminary artillery fire—the position is not safe, and no one can stir without exposing himself. Man is an upright animal, and it seems to me much better to keep a man, whose nerves are in a high state of tension, sitting upright rather than trying to flatten himself upon the ground for bare life.

There should be room for officers or non-commissioned officers to pass along the line without disturbing the men, either when shooting or resting, and for getting a wounded man along in case of need. They need not be capable of being passed by troops in formation. It is the essence of fortification that it enables an inferior force to meet successfully a superior one, partly by saving it from loss and partly by increasing its morale: fewer men therefore, can hold the line, more will be in reserve available for counter-attack; and as the tendency is to concentrate defence works on certain strong points, leaving intervals between, for counter-attacks, it seems reasonable to assume that the counter-attack will be made by the strong reserves in the intervals, and not by the men who have borne the full stress of the attack in the shooting trenches.

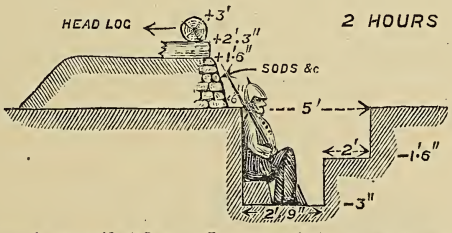
The condition made in the early days of hasty intrenchments, that the cover provided should not be too good lest men should be unwilling to leave it to advance to the attack, seems very unsuited to trenches which men are to hold against a strong attack.

It is necessary to provide proper facilities for leaving the trenches in case of retreat; and where long lines of such trenches are provided, it may be necessary to make some provision for crossing them at certain points by means of either ramps or steps at intervals.

Proper drainage of the trench should be seen to: it is difficult to lay down anything precise regarding this, except that care should be taken that no more water should get into the trench than falls into it: for this purpose small intercepting drains are sometimes necessary.

The section No. 1 is a good type of a shooting trench, which can be constructed in two hours, with men at two paces intervals.

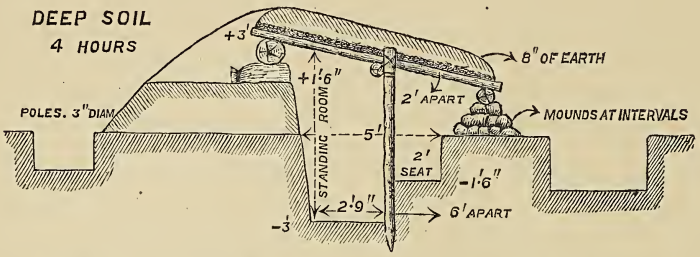
Fig. 1.



When more time is available and materials can be obtained near, it may be desirable to provide overhead cover, as a protection against shrapnel or long range infantry fire: a very moderate amount of cover is sufficient to prevent trenches being searched out. Fig. 2 shows how Fig. 1 may be provided with overhead cover: the whole work being completed in four hours. A few men (about one to four paces of front)

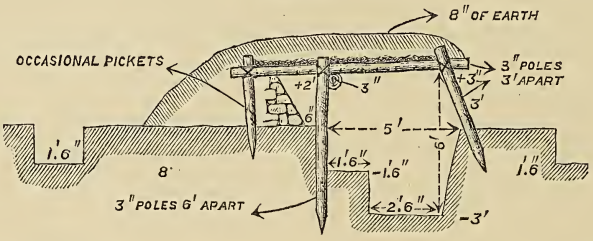
can prepare and bring to site the posts and brushwood during the first two hours while the trench is being got out; and the whole party can complete the work during the remaining two hours.

Fig. 2.



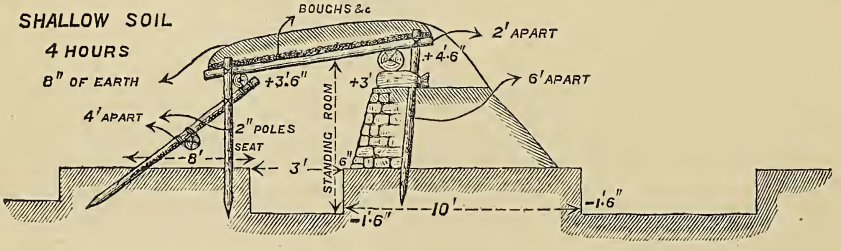
Where sufficient materials are not easily procurable for covering the whole of the trench, small portions can be covered in at intervals, and the men crowded into them when necessary. *See* Fig. 3.

Fig. 3.



Conditions of ground, rock or marsh, may make it impossible to excavate to so great a depth as that shown in Figs. 1 and 2, or the uneven nature of the site may render it impossible for the soldier to see properly to his front unless he is raised higher above the ground than these trenches allow: it must be remembered that the soldier is apt to be uneasy unless he can see what his enemy is doing. This is what constitutes the moral effect of a flank attack: the fear caused by a danger that cannot be seen or appreciated. The importance of carefully selecting the proper sites for shooting trenches has already been referred to, and I would add that only careful observation will teach how small an undulation or irregularity of ground, scarcely noticeable when standing, will screen from view when the eye is only 18 inches above the ground. In such cases breastworks must be constructed instead of shooting trenches. *See* fig. 4 for a simple type, covered

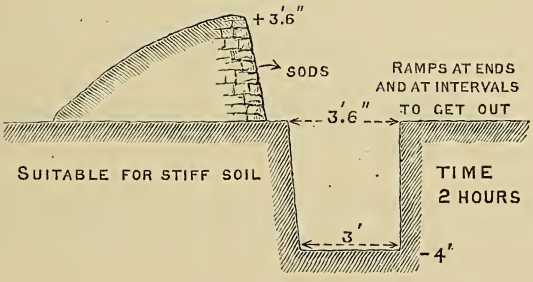
Fig. 4.



in. The disadvantages of the breastwork type are: they are more conspicuous—a serious objection—and they require some revetment to make the earth stand at a slope convenient for a man to fire over, which means extra labour. There is room for the exercise of much skill in arranging for effective revetment with simple materials; sods, clods, stones, reeds, brushwood, timber, &c., must be used as procurable. There is a practical difficulty, that with several kinds of revetment, continuous hurdle work for example, the construction of the revetment cannot well go on simultaneously with the excavation of rear trench, unless the men in the trench are spread very wide apart, so as to be able to throw their earth in between the revetters. A better plan is to excavate the front trench (technically called the ditch) first, backing the earth up against the revetment, which must be pushed on as rapidly as possible, the (rear) trench being executed by the revetters as soon as they have finished the revetment. I would here point out that gabions and fascines can never be made for revetments for "hasty" intrenchments; they take too many men and too much time to make. They may be used, particularly fascines, for improving hastily made works when more time is available, or in the construction of field redoubts. Rough faggots or logs would, however be very useful in all types of works. A few sand bags or other bags may very often be available, and are most useful for providing head cover in the form of loopholes.

In providing cover for supports (and reserves where it is necessary) the condition of being able to fire from the cover is no longer binding, and we can get increased protection by resorting to greater depth of cover. Fig. 5 shows a section suitable for fairly stiff soil, the rough revetment of sods and clods is desirable to bring the cover of the parapet as near to the trench as possible. The small berm is left to prevent the weight of the parapet causing the front of trench to fall in.

Fig. 5.



Where the soil is not stiff enough to stand at such steep slopes as these shown, then the sides of the trench must be made easier, and possibly overhead cover provided. Figs. 6, 7 and 8 show some simple types of such cover. It must be remembered that troops can be

Fig. 6.

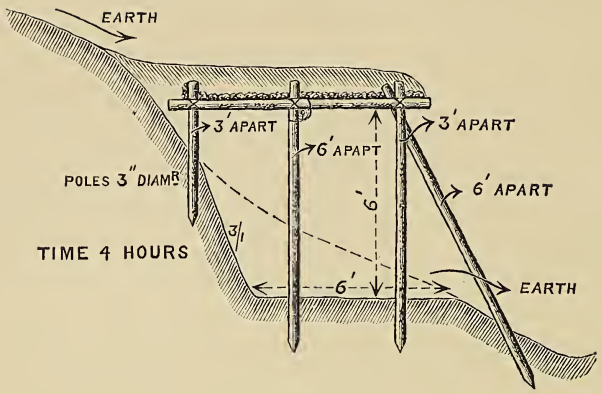


Fig. 7.

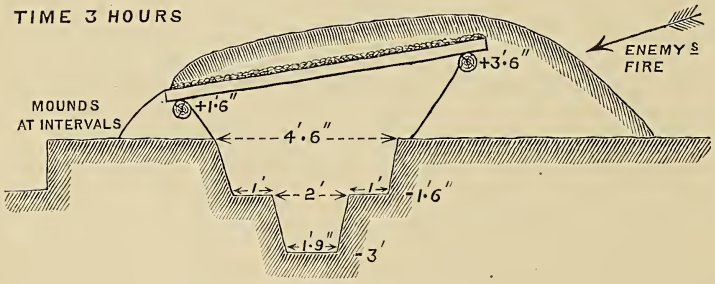
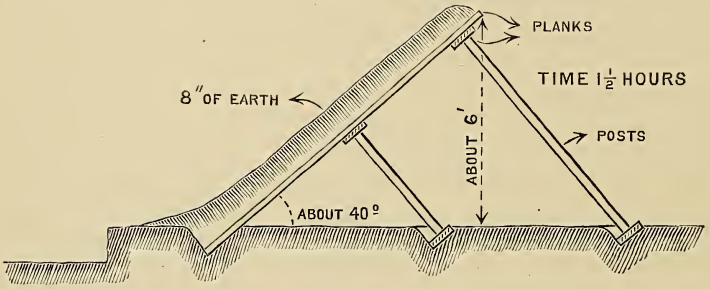


Fig. 8.



crowded into these. Covered or, at least, screened communications may often have to be made between the shooting line and the supports, and possibly the reserves.

(To be Continued).

THE FRENCH MANŒUVRES OF 1891.

BY

CAPTAIN J. F. MANIFOLD, R.A.

This year may be marked as the one in which the training of troops in peace time has been carried out on a scale which, in point of numbers of the men brought together, much more approaches the actual conditions of war than what has ever been seen before in Europe. In Germany, on several previous occasions, two Army Corps have been assembled and manœuvred together, but the numbers have then not exceeded 50,000 or 60,000 men. This year Germany has again assembled about that number at Erfurt, with another large army manœuvring on the Rhine; while Austria has massed the immense number of 70,000 men at Schwarzenau, and, with two Emperors directly superintending the movements of the army, has largely added to the importance of the occasion. It is France, however, which has far surpassed all other military Powers, and which, with manœuvres, at which an army of 120,000 men has taken part, completely puts in the shade all previous records.

The occasion was a notable one for the French nation, as it was the anniversary of the coming of age of the Republic. The end of the war of 1870–71 saw France left absolutely without an army, all her regular troops, together with their arms and equipment, had been captured by the Germans and taken across the Rhine, while all her arsenals, except those in the very south of France, were in the hands of the enemy. The army as a regular force had ceased to exist, and the commencement of 1871 saw France start at the great task of forming an army from the very beginning. The manœuvres, which have just been concluded, show with what effect this work has been carried out, and may be considered to mark a great epoch in the history of the French Republic.

The ground selected for the manœuvres was that lying between the upper portions of the Marne and the Seine, enclosed in a quadrangle, of which Vitry-le-François, Troyes, Clairmont, and St. Dizier form the angles. The geography of this tract of country has been probably more studied by all students of military history, than that of any other part of Europe, as the theatre of Napoleon's great campaign of the early part of 1814, when, by a most brilliant power of concentration, with his small army of 85,000 men, he completely checked the allied forces of Austria, Germany, and Russia from advancing on Paris for the space of four months. The country is, for the most part,

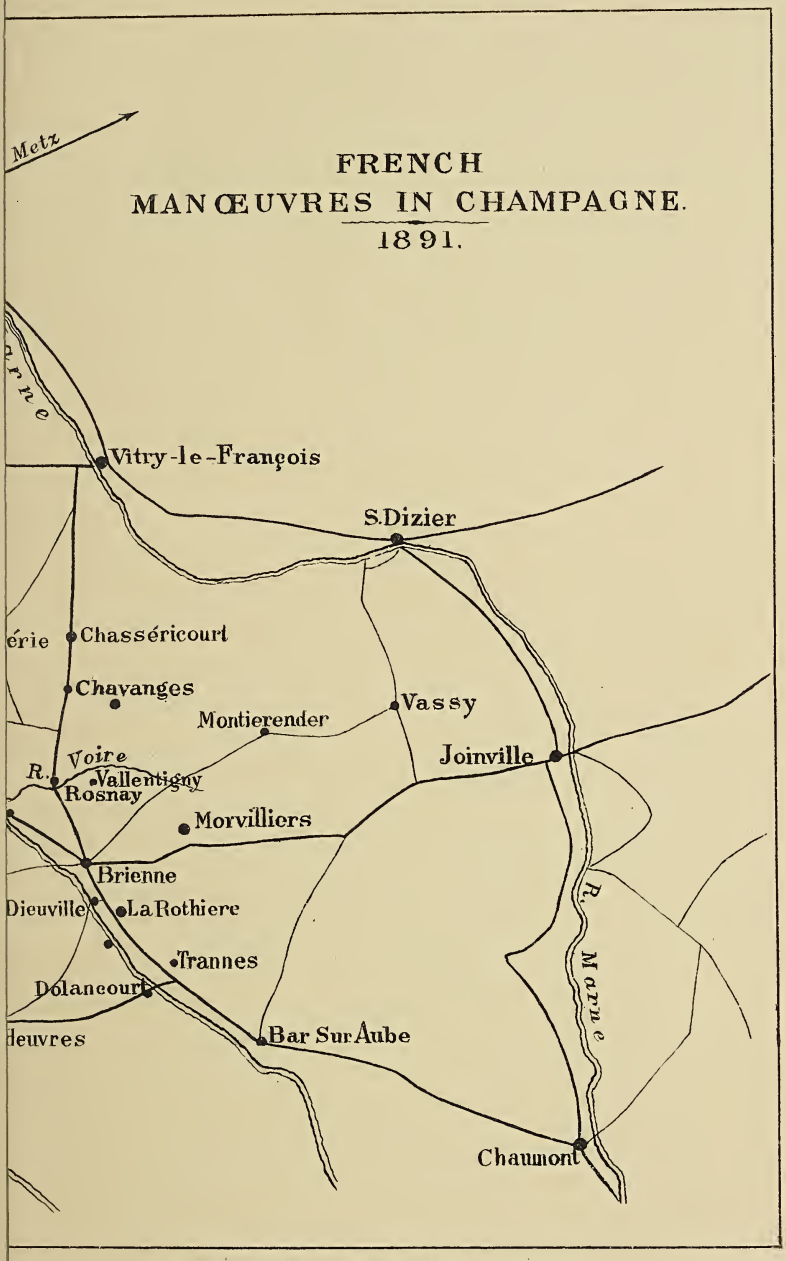
flat, and a good deal cut up by rivers and streams. There are, however, numerous small ranges of hills on which the vines are largely cultivated; these hills afford magnificent artillery positions, and bring the power of artillery greatly to the front. In places there are large woods, but, with a few exceptions, these partake more of the nature of small copses, sufficiently large however to break up the regular advance of any line of infantry, and to make the handling of them a matter of considerable difficulty, as they can hardly pass directly through them, and so are obliged to take ground continually to the right or left in order to avoid them.

The manœuvres may be divided into three stages. The first stage consisted of a series of movements of corps against corps; for the second period the V. and VI. Corps formed one army, known as the Army of the West, under the command of General Gallifet, a cavalry soldier, who first gained distinction as being in command of the Cavalry Division which, at the battle of Sedan, attempted to check the advance of the encircling German army, by a brave, though fruitless advance across the plateau of Illy. This Western army was pitted against what was designated the Eastern Army, composed of the VII. and VIII. Corps, the command being given to General Davoûst, a grand-nephew of Napoleon's famous Marshal of that name.

For the third and last stages the two armies were combined into one force, the whole being under the direction of General Saussier, the present military Governor of Paris, the man on whom, in the event of war, the chief command of the whole armies of France would probably devolve. General Miribel, the chief of the General Staff, acted as his first assistant.

The scheme, under which General Saussier directed the movements of his troops, was one very likely to become a reality in case of war. An enemy has invaded France from the direction of Luxemburg, and having crossed the Argonne, has moved south on that part of the Meuse, which lies between Vitry-le-François and St. Dizier. To meet this invasion, a defending force has been assembled round Vandeuvre, it is ordered to advance northwards at once and drive back the enemy, whose advance-guard is believed to have already crossed the Meuse.

The four corps forming the defending force were in cantonments round Vandeuvre, a town ten miles north of the Seine, between that river and the Aube. Each corps consisted of 25 battalions of Infantry, 8 squadrons of Cavalry, 20 batteries of Artillery, 3 companies of Engineers, 1 Field Bakery, and 1 Ambulance Company. Two divisions of Cavalry, in all 48 squadrons and 6 batteries of Horse Artillery, were attached to this force. In addition, there was a large equipment of bridging material, a field hospital, with all its supplies and carriages, and the most modern arrangements for ballooning. The balloons formed a most striking feature in the many scientific appliances which have been lately introduced into the French army, and in future they should play an important part on the battle-field. They are not exactly a novelty, as for years back they have been used for purposes of observation, but their real value has at these manœuvres been brought much more prominently to the front than heretofore. The



GEORGE KENNING, Lith? 16 GT QUEEN ST LONDON. W. C.

FRENCH MANŒUVRES IN CHAMPAGNE. 1891.

R. Marne
Chateau Thierry
Epernay
To Metz
Chalons
Meaux
Champaubert
Montmirail
Bergères
Paris
R. Marne
Vitry-le-François
Sommesous
Sezanne
S.Dizier
R. Yères
Guignes
S.Ouen
Margérie
Chassércourt
Chavanges
Arcis
R. Aube
Montierender
Vassy
Melun
Pont-sur-Seine
R. Seine
Voire
Charette
R.
Vallentigny
Rosnay
Joinville
Lesmont
Morvilliers
R. Seine
Brienne
Piney
Dieuville
La Rothiere
Montereau
R. Yonne
Troyes
Trannes
Dolancourt
Pont-sur-Yonne
Vandeuvres
Bar Sur Aube
R. Marne
Chaumont

SCALE OF MILES
5 10 15 20 25 MILES

GEORGE KENNING, LITH? 16 G? QUEEN ST LONDON W.C.

balloons were carried from place to place in a cart, and although kept filled, there seemed but little trouble in transporting them about.

The opposing force was quite a skeleton one, it consisted of 14 battalions, 12 squadrons, and 9 batteries of Artillery, under the command of General Boisdeffre, a large part of the Infantry were drawn from the Marines; as with us the men of the Marine battalions enlist for long service, they are, therefore, much older than in the ordinary regiments of the line, many of them had finished their tour of Colonial service and wore medals for the Tonkin Expedition. It was a strange coincidence that precisely the same brigade of Marines which had defended, in February 1814, the line of the Voire, under Marshal Marmont, and had much distinguished itself at the village of Rosnay, should at these manœuvres be detailed for the defence of this very same village, though under very different conditions. The remainder of the Infantry were composed of Chasseurs, the reputation for whose marching power is spread far and wide throughout France. This force represented the advanced-guard of the invaders, its extreme weakness would not have allowed of its offering any real opposition to the army manœuvring against it, but from its size it was able to change its position with handiness and rapidity, and thus great practice was afforded to the General Officers in the various arrangements required in making great changes of direction and the very varying plans for the marches which these changes demanded, while much exactitude was demanded from the subordinate officers in carrying out the instructions and orders of their superiors.

The front of the four Army Corps was covered by the two divisions of Cavalry. Behind the screen thus formed marched the army in four columns, its flanks protected by the four Cavalry brigades of the Army Corps, two brigades on each flank. The whole force moved in a square formation. On the right was the Eastern Army under General Davoûst, the VII. Corps in front, with the VIII. Corps in its rear, each corps forming in itself two columns; a similar formation was adopted by the Western Army, under General Gallifet, the VI. Corps formed into two columns, having the lead, while it in its turn was followed by the V. Corps. This order of march was strictly preserved, but on the field of battle the V., VI., and VII. Corps formed a front line, with the VIII. in reserve.

The regularity with which all the movements of this army were carried out reflected great credit on the working of the Staff, very close touch was kept between the columns as they advanced. General Saussier, who moved by a central road, being always in telegraphic communication with his subordinate commanders. Strict orders were issued as to the timing of passing various points, and the passage of the rivers at the various bridges was carried out with great exactitude. There was a complete absence of all confusion, and the Staff arrangements seemed to work with great ease, and without friction or hurry. Everything seemed to proceed of its own accord, although the great changes of front which were made must have been a severe test on the system, which shows how thoroughly has been perfected the French Staff, to enable it to direct the movements of such a large army of men with so much precision.

The first position occupied by the enemy's advanced-guard was the line of the Voire, and extended from Rosnay to the junction of the Voire and Aube. From this position he was dislodged and fell back towards the north; being a skeleton force, he manœuvred with great ease and rapidity, and the great wheels and changes of direction which he obliged the repelling force to make were the cause of the very severe and long marches which were executed by the troops moving on the outer flanks of the army.

The great feature of the advance of the army took place on the enemy's retreating behind the line of the Voire. The position to which he fell back was considered absolutely unassailable by day, but it was of primary importance that he should be driven from it. In order to effect this, General Saussier determined on approaching it by a night march, followed by an attack just before dawn. The whole plan and proceedings reminded one somewhat of our own advance against Tel-el-Kebir. In all future campaigns night attacks must play an important part, and if they are to be carried out successfully, the staff of an army must have practical experience in working out the minutive of every detail, which have to be carried out with so much more exactitude by night than by day.

An army finds itself in front of a position such as that of the Voire, to advance against it, even if the most terrible loss is allowed for, affords but small chance of success, nothing can be done unless the position can be carried by surprise, and this can only be effected under the cover of night. Time, too, that great factor in all modern battles, will be saved, so that, if circumstances in any way permit, a night attack, with its many accidents and dangers, must be risked. Everything favoured General Saussier on the present occasion, a clear night with a good moon, and every detail of the ground known to the staff. Absolute secrecy was preserved regarding the movement, the two Brigadiers not even receiving their orders till late in the afternoon of the day proceeding the night's march.

Till one o'clock perfect quiet was preserved in the cantonments, but at that hour the men were roused. At three o'clock the enemy's position was reached and firing commenced, the flashes, unobscured by smoke, being very bright, pointed out the positions of the troops. Soon after four the day began to appear, but by this time the batteries were well in position and overwhelming the enemy with a murderous fire, while the infantry were well on their way across the most dangerous zone of fire. The whole operation was successfully carried out, and by 6 a.m. the umpires gave their decision that the position had been carried, and the men were marched for their billets. Being Sunday, they were given the remainder of the day for rest, and it would have been difficult to find a body of men who, in peace time, would have appeared more thoroughly tired out and stale than did the French army that afternoon; as they lay in the shade they gave one the idea of a hunter thoroughly worn out by a series of long days; but, notwithstanding their fatigue, they retained great spirit, and lively jokes and chaff never flagged between the men reposing by the road side and any comrade who might pass by. That never failing spirit of fun is, what

strikes one, as being the very life of the French army; it will carry men through many hardships if backed up by a really sound discipline.

On the following day the most important engagement of the manœuvres took place. The enemy, under General Boisdeffre, having been driven from their position on the right bank of the Voire, had retreated about seven miles further north, and taken up a strong line of defence, formed by a series of hills, with several villages to act as main points in the line of defence; of these, Corbeil on the right and Margérie on the left centre, formed the keys of the position.

The plan adopted by the attackers was to carry out a strong turning movement against Corbeil, driving back the defenders from their right into the Sois valley. This portion of the attack was assigned to the Army of the West, under General Gallifet. The Eastern Army was directed to envelop the left of the position, which was rendered very secure by excellent artillery positions on the right of Chassécourt, overlooking the railway station of that name on the line running south from Vitry towards the Seine. The main attack was directed against both flanks, the centre, as far as one could observe, being somewhat neglected. Every effort was directed so as to work round the flanks of the position and take it to a certain extent in rear, and in every engagement during the manœuvres this appeared to be the great aim and object of the attack. The front covered extended over six or seven miles, so the number of men per yard must have been quite seven or eight; the depth of formation of the attack was most striking, there seemed to be no end to the lines which followed, one on the other, in rapid succession, the formations becoming denser and denser as the distance from the rear diminished. The ruling idea seemed to trust in the sheer weight of numbers breaking down all resistance on the part of the defenders; granted that one half of the first line is killed, let their places be filled up from the rear, but let the attack proceed at all costs. This plan sounds well, and it is one which might do while an army is completely playing a winning game and has success on its side to carry it forward, but let it become somewhat disheartened by heavy losses, and the difficulty and danger of carrying out such tactics would be very hard to get over.

The system, too, of instructing the enemy to take every advantage of cover, would appear to be followed to an exaggerated extent, not only did the firing line conceal itself on every possible occasion, but directly it halted to fire its supports were led off to the right or left to obtain concealment from the nearest hedge, or whatever other form of cover might be at hand. The men were extremely clever in finding cover, and no confusion or delay occurred in getting them to move forward again; but the plan carried out by the French must be a very dangerous one, let men, trained and disciplined as they may be, suffer heavily in their advance, and they will soon lose that keenness for facing a shower of lead and leaving the cover they have once taken.

The Artillery took a most leading part in this engagement. The Infantry of the advanced-guard first came into contact with the enemy on a line of hills, which was held in advance of the main position by a battalion of Chasseurs. The latter were quickly driven in, but the

advanced-guard was soon checked, by coming under the fire of the main position. The batteries attached to the advanced-guard were at once brought forward and opened fire on whatever portions of the enemy's position could be distinguished. The defender's position was so well selected that it was difficult to pick out any well defined target, until the fire, which they directed on the guns, somewhat exposed their position; but even then, the smokeless powder gave a very indistinct clue to the exact spot at which to aim.

As the fight developed a very strong Artillery fire was directed against the main defensive localities in the position, large masses of batteries were employed together, as many as twelve being in one line, with their fire concentrated on the front, against which the portion of the attack opposite to it was being directed. To enable these batteries to be brought into action at an early stage of the fight, the Artillery marched well towards the head of the advanced-guard or main-body, as the case might be, following directly behind the leading battalion. Fire was opened at a range not exceeding 2500 yards, and all through the engagement excessively long range firing was avoided. The Artillery of the main-body was rapidly moved forward into line with the advanced-guard batteries, and under the support of their combined fire the Infantry advanced to the attack. Both flanks of the position were gradually enveloped by the attacking force, the Artillery moving forward to closer ranges as the Infantry advanced in the successive stages of the battle. The final phase of the attack was a charge made in great strength by the Cavalry Division of the Army of the West against the enemy's left flank; this was considered the finishing blow, and the "cease firing" then sounded. The day had been a long one, as many of the troops began marching at 4 a.m. for the positions assigned to them in the line of attack; the actual fighting commenced at 9 a.m., but a great deal of hard marching had been done before that hour. The day was excessively hot, warmer than anything to be experienced out of India; there were no stragglers, and very few men fell out except those thoroughly exhausted; there were, however, numerous cases of sunstroke.

All the foreign Military Attachés were present. They arrived at the Chavanges Station about 9 a.m., having travelled by special train from St. Dizier, where they lived during the latter part of the manœuvres. The arrangements made for their seeing the work of the army would appear to have been satisfactory, notwithstanding that one heard reports to the contrary. The horses were supplied from the Ecole Militaire at Paris, and were sent daily from place to place, according to whichever railway station was the most central for the day's operations, while the Attachés travelled by train. The Military Attachés were the only foreign officers who attended the manœuvres in uniform, or as guests of the French Government.

The manœuvres were of a most interesting nature, and it was something in itself to see 120,000 men assembled together, and to witness the arrangements necessary for the feeding and maintaining in the field of such an immense host. Unless one was officially accredited, or had a personal acquaintance with French officers, it was difficult to

obtain accurate information on questions of staff organisation, the issue of orders and other important points, but by moving about amongst the men, one was able to see a great deal in connection with the ordinary and every day life of the French soldier on service.

One of the first points that strikes one is the wonderful handiness and readiness with which the French soldier adapts himself to the exigencies of camp life. An Englishman would often starve where a Frenchman lives well. The plan of messing adopted in the French army is one which is admirably suited to the nature of the men from which the army is drawn. Messes are formed of twelve, with a corporal or junior non-commissioned officer at its head, and every arrangement for cooking is made by the members of the mess, who carry the cooking pots as part of their ordinary kit. As a regiment approaches the end of its march, the men may be seen picking up a few dry sticks, or anything which will be useful for fuel, so that, by the time cantonments are reached, a very fair bundle of fire-wood will have been collected for the mess. Directly the men are broken off, one member of the mess sets to work to make a primitive stove, which is completed in a very few minutes, three large stones being all the building material required; in this a fire is quickly lit from the bundle of sticks which the men forming the mess have collected, the necessary draught for the fire being strengthened by scraping the earth away from beneath the hearth, so as to form a flue or passage for the air. While this is being done, another man fetches water in the mess kettle, and on his return, the meat, vegetables, and every form of food is put in the pot. Within an hour soup is ready, this is strained off, and the meat and vegetables left behind are eaten as a stew at the evening meal. This plan of living could not be copied by every army, but it is admirably suited to the ways and habits of the French who, even amongst the poorer classes, possess a sound knowledge of cooking, each man is made to feel that his own comfort and well-being depends entirely on himself, and on the care with which he sees to strict economy in the disposal of his daily ration. Thrifty habits ensue, and all waste of a necessarily scanty ration is avoided. Besides which, elaborate arrangements for camp kitchens are done away with, and the carriage required for all the paraphernalia, which attend on such luxurious ways of living, avoided.

The men were much crowded together in the villages in which they were billeted, for to collect 120,000 men into a poor and rather sparsely populated district, and to house them all is a very difficult matter. The men slept in the barns, stables, out-houses, cow-sheds, and wherever it was possible to find any form of cover; the proprietors and peasants were very much crowded, as they had all to find accommodation for a certain number of officers and men in their private houses. Blankets were not carried, the men slept in their long blue capotes, without any extra clothing beyond what they might carry in their packs; this was no hardship, as the weather was very warm and dry, and the men were so closely packed that they were more likely to suffer from heat than cold.

Owing to the excessive warmth of the weather, orders were issued that

the sale to the men of all kinds of brandies, liqueurs, &c., was strictly forbidden, and a sentry was always placed at the door of every village café and beer-house, where the men were billetted, both to preserve order and to see that the regulations regarding the sale of liquors was enforced. The sentries appeared to carry out the order regarding the sale of liquors, more in its breach than its observance. If the men wished to have any forbidden liquor they simply entered the inner room of the inn, into which it was an understood thing that the sentry should not enter. On one occasion it was rather amusing to see a large number of the band of one of the regiments, who wished to have a drink with a friend of a somewhat more powerful kind than that allowed by regulations, tell the sentry, in the most unabashed manner, that he was not to interfere with their small carouse, but to walk about in the street; the gates of the inn yard were then closed, and they all sat down and the entertainment went on right merrily. Drinking was in most absolute moderation, and a drunken soldier was unknown; still, the manner in which the orders were disobeyed, and the authority of a sentry set aside in these minor matters, did not speak highly for the tone of discipline in small affairs. But the absence of a really strict and severe discipline seemed to be the weak point in the French army; there does not appear to exist that iron grip over the men which is to be found in other armies, the Republican feeling of equality is too strongly developed in the nation to allow of it. The system of discipline is hard to understand; it is one which is peculiar to the French army. It must be found to answer, as under it men accomplish the most fatiguing marches in great heat, and without a straggler or man falling out. As an example of the heat, it was reported that in one regiment four men died in one day from sunstroke. The officers looked most thoroughly after the interests of their men, and the men who showed signs of footsoreness, or any of the other trivial complaints which will rapidly decimate the finest army, were always attended to by their non-commissioned officers directly a regiment was broken off. Responsibility seemed thoroughly well distributed through every grade, officers and non-commissioned officers had each their special task, and they seemed to perform it very conscientiously. There was very little delay in getting the men into their billets, every house and building was marked off carefully for the number of men assigned to it, and directly the men were broken off they were at once guided to their quarters by the non-commissioned officers; a good spirit and feeling seemed to exist between all ranks, and officers were in thorough sympathy with their men, but the distinction between grades was not sufficiently marked, and the general bearing too free and easy to fulfil the conditions necessary to a really strict discipline.

The bread and vegetable rations supplied to the men were most liberal, but the quantity of meat was small, and the quality would have been considered most inferior in England. Bread was always issued the evening before the day for which it was required and carried by the men in their haversacks, but the meat was not distributed till the day for which it was required. In addition to fresh rations, a proportion of the men carried a tin of preserved meat as a reserve, this

ensured a supply of meat being always at hand to fall back on, if required, but it added very much to the weight carried by the men, which appeared very much heavier than with us, a serious matter when every march was made and battle fought with the men in the heaviest of marching order. This preserved ration was only drawn on when special orders were issued to that effect, and a fresh issue was at once made by the Commissariat. The men seemed satisfied with their food, and the Commissariat were quite able to stand the strain brought on it, and were always up to time in making their issues.

Wheaten bread was entirely eaten by the army, for its supply large bakeries, with a permanent staff, were formed, the principal of these were at Troyes and Chaumont, and during the latter part of the manœuvres there was one at Valentigny. The bakers seemed to be the hardest worked men in the army, they all worked stripped to the waist, and seemed much exhausted from the damp heat in which they baked.

The Artillery is quite the best part of the French army, and all Frenchmen seem to have a very high opinion of its efficiency. In the early stages of an engagement it was entirely made use of in masses, the three batteries of the Brigade Division or group always working together, the unity between the batteries of a Division being as close as that which exists between the three sections of a battery with us. A single battery never moved separately to take up a fresh position, the employment of Artillery by Brigade Divisions was completely the rule, and the use of isolated batteries quite contrary to orders, unless under most exceptional circumstances.

Before coming into action the Lieutenant-Colonel of the Brigade Division, accompanied by a trumpeter detached as an orderly from each battery of his command, always rode forward and examined carefully the position about to be taken up, and on a signal the Majors who followed him, but kept some distance in rear, joined him. The object to be fired at was at once pointed out, and the general line to be occupied by the batteries shown. The Battery Commanders quickly examined the spot their battery would occupy in action, and having done so, directed their batteries, which had already been brought up close to the position, into the places assigned to them. Very little time was lost in all this, as the Battery Commanders always galloped on ahead of their batteries and had everything prepared by the time the batteries arrived at the position. In some instances the Battery Commanders remained fronting the centre of the positions which the batteries would occupy till their batteries came up, in other cases they rode back a short distance and, having met them, lead them forward themselves, but the plan employed would appear to depend on the nature of the ground and the amount of time at disposal.

Positions were but seldom changed after once been taken up, unless there was a decided advantage in so doing, and an advance of less than 500 yards at a time was never made. It was quite understood that batteries should fire over the heads of infantry advancing to the attack of the position against which the Artillery fire was directed; this was, however, done with perfect safety, as in most cases the Artillery

positions were selected on the ridges of the hills, the fire was kept up till the Infantry approached very close to the points against which their attack was directed. This could be done with much more impunity when smokeless powder is used than with ordinary black powder, as with the former explosive every movement of friends or foes can be distinctly followed, and there should be no danger of the fire not being discontinued when the opposing sides have met. The Artillery even fired in tiers where the ground was sufficiently elevated to allow of this being done, and where positions were too cramped to allow of all the batteries forming on one line. Excessively long ranges were avoided, batteries did not commence firing, even in the early stages of a battle, at over 3000 yards, beyond these ranges the French gunners hold that observation ceases to be accurate or trustworthy, and that a very great deal of ammunition may be wasted to no purpose. The greatest importance is put on power of observation, the tripod of the long telescope being generally in its place before the limbers have got clear from the guns; much pains and time is expended in training observers.

In change of position and in coming into action, the gunners of the Field Batteries were always carried on the limbers and wagons, but on the line of march the gunners were always on foot. The iron rail which passes completely round the limbers makes the gunners' seats much more comfortable than with us, who have only the hand rail for the men to grasp; the rail passes completely round the wagon-body, the gunners' kits, which are carried inside of it, being thus prevented from falling off, as the kits are not strapped firmly to the boxes.

On the offensive there was no attempt made to dig gun-pits, these being considered quite incompatible with any change of position in support of the advance of Infantry, even if the great amount of time required for their construction is not taken into account. Batteries appeared to come into action to the front, and no attempt was made to unlimber on the reverse slopes of the hills and run up by hand, no doubt this would have been done had it been in any way advantageous, but how few positions will allow of this without loss of time and great labour to the detachments; the limbers were at once taken to the rear and formed up under cover, the ammunition being supplied from the wagons, one wagon remaining with each section. The teams were not unhooked, but this would not have been the case on actual service, as, according to the regulations, teams should be taken out whenever possible. The horses' heads faced the front, and were formed between their sections and about ten yards to the rear.

Ranging was done independently by batteries; directly a gun was ready to be fired the No. 3 raised his hand and the Battery Commander signalled "Fire," the result of the round being reported by an observer looking through a powerful telescope which was placed a few yards to either flank of the battery, but, as only blank ammunition was used, no practical information regarding the ranging of a battery could be obtained, nor the number of rounds required ordinarily in so doing. The flank to which the Battery Commander or observer stood was quite immaterial, as the smokeless powder in use with the French Artillery in no way interferes with the vision, it is absolutely smokeless, even

more so than cordite, on discharge a small quantity of fine white dust appears at the muzzle, but this is instantly dissipated and disappears in the air.

The positions for the Artillery were always carefully selected before the guns arrived on the ground, and great care was observed in seeing that the positions fulfilled the conditions necessary for effective fire. As a rule, the guns came into action on the slopes of the hills facing the enemy, the limbers being formed up behind the reverse slopes. All the hills affording suitable Artillery positions were covered with vines, and as these are now mainly trained on wire, it was quite impossible for the Artillery to advance in line; column of route became, therefore, a necessity, to enable batteries to traverse the maize-like intricacies of the vines, without doing great injury to the plants. The pace in taking up a position did not exceed a slow trot, so that a Battery Commander, by galloping ahead of his battery, had ample time to select a place for his guns before the latter, which were brought forward under the command of the senior Lieutenant, could arrive on the position. Range-finders did not appear to be made use of, trial shots being altogether trusted to. Perfect silence was preserved, not a word being spoken by officers or men, change of pace, direction, or any new formation being always ordered by signal from the Commanding Officer and transmitted in a similar manner by his subordinate officers. There was a complete absence of needless bustle, hurry, or confusion, and batteries moved with great precision, and though the pace was slow as compared to the rate at which English batteries move, still the manner in which all manœuvres were executed, gave one the idea that both officers and men were thorough professional workmen at their business, there being no appearance of the work being in any way novel or unusual, but such as was being executed every day. No doubt existed on such questions as to what should be done with the limbers and wagons on coming into action, how ammunition should be supplied and served, how ranges should be found, small duties in themselves, but which, if not arranged for and carefully rehearsed till they are performed with mechanical precision, lead to endless confusion, and cause the work of Artillery to be done more after the fashion of amateurs than highly trained professionals.

All the gunners carried carbines and appeared a good deal encumbered by such an unnecessary arm. The drivers were armed with swords, attached to the saddle by a frog, and wore a revolver, which is carried in the waist-belt. The Artillery horses were strong but coarse, and lacked quality, they were all drawn very fine, which was only natural after the severe work they had gone through. The general turn-out of the batteries was poor and the harness very dirty, and the horses had a very rough and uncared-for appearance, but the men, on the other hand, were thoroughly well trained in the important duties of gunners, their slovenly turn out was also largely increased by the large number of reservists attached to each battery. The clothing of these men is generally very ill-fitting, they are badly set up, and are the very opposite to what we would call smart, but during their three years of active service they must be thoroughly well grounded in their drills,

as they seemed in the matter of the really essential parts of their duties to be thoroughly at home, and to have no hesitation in carrying out any part of their work. Under the three years' system of enlistment now universal in every branch of the French army, there is not time for everything, so the niceties of detail as to smartness have to be foregone in favour of the more important gunner's duties; the extent to which "spit and polish" is carried out in our Regiments is a cause of much jeering amongst outsiders, but they very often overlook how great are the disciplinary benefits which accrue from our somewhat excessive cleanliness, and what beneficial effects habits of neatness have on the class of men from whom our ranks are filled, men who, in their youth, are in no way trained to order or obedience.

A horse blanket is carried under the saddle in place of our numnah, an arrangement formerly in use with us, and one to which we might return with advantage, great care is, of course, necessary in folding the blanket to avoid all inequalities of folds under the saddle, but with due care this should be possible. Pole draught seemed to work very well, the carriages were turned and managed easily, though the driving was a long way inferior to that of our men. The bitting of the hand horses is very simple, being only an ordinary jointed snaffle, it seemed quite sufficient for the control of the horses, who, after their fortnight's manœuvring, showed no tendency or desire to run away, and might have been led by a thread. Neither side nor bearing reins were to be seen. Breast harness is entirely used, it would seem to act very well, and no horses showed signs of being galled about the points of the shoulders. The traces very much resembled those which were issued this year to the 66th Field Battery as an experiment. The piped end of the trace which lies against the horse's side is of pliant flat leather, and the rope ends are made of two light ropes, the lead traces can be shortened so as to be used for the wheel, so that but one pattern of trace is required. A set of French harness is lighter by a good many pounds than an English set, such heavy leather, as is used for our breechings and backbands, being never seen. The girths are made of twisted string and look very neat. Wallets very much resembled our own pattern, but some batteries were equipped with saddle bags, which were slung across the horse behind the saddle.

The Horse Artillery gun has a calibre of 80 millimetres and fires a 12 lb. shell, the gun and carriage weighs about 31 cwt., but in marching order it is heavier than this. The Field Batteries are armed with a gun of 90 millimetres calibre, firing a shell of 8 kilogrammes, or about 17 lbs. The charge of powder used with the 90 millimetre gun is in proportion to the calibre smaller than that of the 80 millimetre gun, the latter gun consequently gives a considerably higher muzzle velocity. There is also a gun of position of 95 millimetres, the shooting of which is said to be very good; French artillerists say that this is the best gun in Europe. Several howitzer batteries were also equipped, their shells are supposed to be loaded with melinite or other high explosive, but everything connected with these batteries was kept a profound secret, and it was difficult to obtain any information regarding them.

The Cavalry is the arm of the service which received the most severe criticism, and in which the French, as a nation, appear to take the least pride. They will even go as far as to draw invidious comparisons between their own and the German Cavalry, for whom a very lively respect is still entertained throughout the country. The Cavalry was employed for shock effect in immense masses, operating principally on the flanks, but no great collision took place between Cavalry and Infantry till at the end of a battle, aad it was considered that the enemy were so shattered and beaten as to lend themselves an easy prey. At the engagement at Margérie during the last phase of the manœuvres, advantage was taken of that part of the railway, between the stations of Chavanges and Chassércourt, to enable the Cavalry Division of the Western Army to deliver a very fine charge against the left flank, which was already being driven from its position by the attacking Infantry. The Cavalry have been well drilled, for after one of these great charges the ranks were still in good order, and the men were well in hand and under control. The Cavalry, themselves say, that the establishment of officers to each regiment is too small, and that any losses, which they might incur early in a campaign, might render a regiment quite inefficient. That the number of officers is small would seem to be the case, as the day M. Freycinet, the War Minister, attended the manœuvres, an officer could not be spared for his escort, which was put in charge of a sous-officer. The want of a reserve of horses for each regiment was also a cause of complaint, each regiment numbers five hundred horses, but there does not appear to be any systematic plan for replenishing the losses which must incur at the first engagements.

The horses are much smaller and lighter than with us, they do not look to average more than 15 hands, and appear much overweighted by the rider, heavy kit, and arms which they carry, they were all drawn very fine and showed signs of the severe work they had gone through, but this was not to be wondered at, as the distances they covered were very great. Thus, after the engagement at Margérie, a considerable number of Cavalry had to march into Vitry for their billets, a distance of about twelve miles, and that after taking a very considerable part in the great battle, which did not end till two o'clock in the afternoon. The Cavalry entered the town about six o'clock in the evening, the horses were stabled in the market place and surrounding buildings, and a good many stood out in the bye roads of the town. The saddles were at once removed and the blankets put on, a wisp of hay being put under each side of the very narrow body roller to keep it off the horse's back. Very little trouble was expended in grooming, the dust and mud was washed off each horse's legs and then wiped over with a wisp of straw. The blanket was then removed and the body hurriedly brushed over with a dandy-brush, stables did not last more than a quarter-of-an-hour. When the saddles were taken off some bad raws could be seen, the side galls appeared to be the worst, these were apparent at a distance of many yards, and as a stranger did not have an opportunity of looking closely to the state of the horses, one might infer that girth galls and lesser rubs were also numerous.

The supply of hay available seemed very scanty, and straw was mainly used for food, the trusses being simply opened and the straw shaken out in front of each horse. As all threshing is done by the somewhat primitive plan of flailing, it is probable that a certain amount of grain remains in the stalks, so that a good deal more nutriment is left in the straw than would be the case if threshed out by machinery. Straw is, however, largely used for feeding all over the Continent, and the results of a number of experiments made in feeding on straw and other foods, as given by Major Phillpotts in a back number of the R.A. Institution "Proceedings," showed that horses could do severe work on a straw ration without loss of weight.

The front rank men, who were armed with lances, seemed a good deal overloaded by sword, carbine and lance, but although the officers said it was difficult to make men efficient in handling the latter weapon, where the time at their disposal was so limited, still they were in favour of its introduction. A very useful part of the Cavalry equipment is a strong canvas water bucket, which closes up after the manner of an opera hat, and which was put to a great many uses. The Cavalry officers are, in the matter of dress and general appearance, much the smartest in the French army, the flowing dimensions which their pantaloons have recently assumed, savour very much of Mr. Tantz, or rather more so. The men, on the other hand, are badly turned out, and would, in appearance, make a very poor show alongside of a trooper from any Cavalry regiment in our service. Their tunics are badly made, while their overalls are fitted as if the rider's leg was simply put inside of a loose sack, with a trimming of leather at the bottom. The cuirasses do not strike one as being very serviceable for modern warfare, and must be very cumbersome for the wearer.

France has left nothing undone to bring its army to a high state of efficiency, and science has been largely used in achieving this end. The employment of balloons had a very striking effect. General de Gallifet, who commanded the Eastern Army, was such a firm believer in the advantage they gave on the battle-field, that he commanded at one of the main engagements from the car of his balloon, communicating his orders by telephone to the staff below. The power of observation, which can be obtained from an altitude of 1000 feet, is very great; not only can the enemy be distinctly seen, but what is of equal, or even more importance, is the rapidity with which the progress and movements of one's own army can be at once seen and orders issued, as may be considered necessary without a moment's delay.

The powder in use by the Artillery and Infantry is absolutely smokeless. All officers spoke very highly of it, and said that it deteriorated in no way through being kept. To the spectator a battle has become a most striking sight, the movements of all troops can be seen, and the general effect is most vivid and brilliant. The difficulties with which a Commander-in-Chief has to contend in the matter of knowing exactly what his troops are doing and how the fight is progressing, should be very considerably diminished, as he can now see distinctly everything which takes place before him. The advantage given to the defenders is considerable, and particularly so to the Artillery of the defence; guns

properly placed behind cover are at any time a difficult target, directly they opened fire with black powder their position was disclosed, now the only sign they give of their presence is a flash; for an attacking artillery to fire at such an indistinct mark, the difficulty is very considerable, but for Infantry, advancing to the attack, to aim with accuracy at such an indistinct target will be well nigh an impossibility. There will be nothing for them to see but flash succeeding flash, and less aim even than heretofore will be taken. Higher training on the part of the Infantry may overcome some of these difficulties, but will this be a possibility under short service, which has been shortened year after year till it has reached the absolute minimum of three years, and now threatens to become two.

Smokeless powders altogether favour the defender, who, in no way disclosing his position, can distinctly see every movement made by the attacking force, and will, from the longest distances, deliver a deadly fire at ranges already roughly obtained; both the Artillery and Infantry must suffer terribly as they change from position to position, the fire of the latter arm especially comparing unfavourably with that of the defence. The defenders need not for a moment feel afraid of running short of ammunition, while the attacking force will have every reason to dread such a calamity. These advantages were always on the side of the defence, but with a line of fire absolutely unhindered by smoke, they are doubled and trebled, and must largely counterbalance the moral gain which the excitement of moving, and the exhilirating effect of continually advancing, have heretofore given to the attack.

One of the many practical operations carried out at these manœuvres was the restoration of the line running from Vitry-le-Français to Bar-sur-Aube. A railway bridge, between the stations of Malthaux and Brienne, was supposed to have been destroyed by the enemy, and in order to keep open communications with the rear, it was considered of the utmost importance that the bridge should be at once restored. In order to make the work more difficult, the embankments leading to the bridge were supposed to have been destroyed by the enemy, and consequently it became necessary to make a new roadway. The work was entirely carried out by the Engineers. In time of war, considerable aid would have been given by the Infantry, but as General Saussier did not care to withdraw any of his men from the more instructive work of the manœuvres, labourers were hired from Troyes and the neighbouring villages. The work was carried on at night by the aid of the electric light, and the bridge and ramps were completed and a train passed over within seven days from its being commenced. The work actually done comprised about 500 yards of a new embankment, and a bridge from 40 to 50 yards long.

It would be absurd for any one not thoroughly experienced in staff duties to attempt to criticise the great machinery which moved this army, but a practical test of its efficiency, which was apparent to all, was the smooth manner in which everything worked. After a long day's manœuvring, orders were necessarily late in being issued, it almost appeared as if purposely so, in order to keep the movements for the succeeding day as secret as possible; when once issued, they

were circulated through the various channels with great rapidity and regularity. The staff appeared to be most efficient in the field, there was no fuss or hurry, and everything went on with mechanical precision, changes in the original plan and direction of an attack being made without any apparent difficulty, so as to suit unexpected contingencies. In cantonments, all messages for the staff were carried by bicyclists, a certain number being attached to the head-quarters of each brigade and division. The saving of horses thus effected was of great value, as even with this help, the Cavalry largely complained of the number of men they had to detach from their regiments for orderly duties and other employments.

What is to be most admired in the French army is the spirit of the men. After a trying and fatiguing day's work, there was no sign of dejection, and the flow of chaff passing between the various messes as they sat on the roadside eating their evening meal was most inspiriting. The officers looked well to the comfort of their men, and there seemed to be a strong feeling of sympathy between all ranks. The discipline, as said before, is peculiar to the French army, to us it appears much too free and easy, but whatever may be the lines on which it is founded, it possesses the power of enabling men, who are carrying the heaviest of kits, to make long marches and to go through all kinds of fatigue without hardly a man falling out from the ranks. The system appears slack, and it would never do for an army, constituted as is ours, but it suits the French, and through it an immense amount of work is got out of the men, without the semblance of grumbling or a murmur.

Manœuvres, as carried out in peace time, must always be of a very artificial nature, the really important point of the effect of losses from killed and wounded hardly entering into account, and the use of blank ammunition destroying much of the reality of the situations; but the great amount of physical and moral energy demanded from the officers and men is a very high training in itself, while the test put on the capabilities of the Commissariat and other departments very nearly approaches the actual demands of war.

The manœuvres have shown that France possesses Generals capable of commanding on service the immense armies, amounting on paper to over three millions, which, under the new regulations of service, she should be able to place in the field. General Saussier, the chief director of the operations, showed himself a man of great activity and energy, and his arrangements were thoroughly practical, his two subordinates, Generals de Gallifet and Davoûst, gave him the most able support. In equipment there is but little wanting to render the French army perfect, money and science have both done their share, and if in wartime the men acquit themselves as well as they have done during the late manœuvres, the French nation should have the satisfaction of knowing that the millions they have expended on National insurance has not been wasted.

NOTES OF TWO LECTURES

ON

FIELD FORTIFICATION,

Delivered at the School of Gunnery, Shoeburyness.

BY

MAJOR RABAN, R.E.

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(Continued from No. 2, Vol. XIX.—Part II.)

Obstacles.

After providing for cover and communications, the next point to consider is the use of obstacles. There is much difference of opinion as to the necessity for any extensive use of obstacles at the present time, and there are some who assert that, provided there is a clear field of fire to a moderate range in front of good troops armed with modern rifles, no obstacles are necessary. This is no doubt true under certain conditions, but it is all a matter of conditions. Let me give two instances and see what may be deduced from them :—

Battle of Fredericksburg, December 1862.

Right Attack.—"Fifteen minutes passed and another division, Hancock's, rushed forward from the town. Zooke's brigade led the way, but quickly recoiled, beaten back by that terrible artillery. Not so its successor. Under cover of the further bank of the ravine the Irish Brigade, under General Meagher, threw off their haversacks and blankets and deployed into line. Resolutely the 1200, for they were no more, breasted the slope and faced the death dealing storm; swiftly they passed the limit marked by the three solitary colours, and shoulder to shoulder their own green flag, and the blue and scarlet of the Union standard waving above them, swept forward against the low wall which skirts the base of Marye's Hill. * * * * * * * * * * * * One hundred and fifty paces from the hill the brigade halted and fired a volley, while the round shot tore freely through the ordered line. Still no sign from the wall looming grim and silent through the battle smoke, and again the battalions moved swiftly forward. They were but a hundred yards from their goal, unbroken and unfaltering : still they had reached a point where Walton's gunners, unable to depress their pieces further, could no longer harass them. Victory seemed within their grasp, and a shout went up from the shattered ranks. Suddenly a sheet of flame leaped from the parapet, and 1200 rifles,

plied by cool and unshaken men, concentrated a murderous fire upon the advancing line. To their glory, be it told, though scores were swept away, falling in their tracks, like corn before the sickle, the ever thinning ranks dashed on.

But before that threatening onset the Confederate veterans never quailed: volley on volley sped with deadly precision, and at so short a range every bullet found its mark. For a while the stormers struggled on desperate and defiant, but no men could long face that terrible fire, scathing and irresistible as the lightning, and at length the broken files gave ground. Slowly and sullenly they fell back; fell back to fight no more that day, for beneath the smoke cloud that rolled about Marye's Hill, the Irish Brigade had ceased to exist. Of 1200 officers and men, 937 had fallen. Forty yards from the wall where the charge was stayed the dead and dying lay piled in heaps, and one body, supposed to be that of an officer, was found within 15 yards of the parapet." —(*The Campaign of Fredericksburg, by a Line Officer*).

Afghan War, 1879–80.

Camp at Fort Battye, October 26th, 1879.—Garrison—100, 4th Madras Native Infantry; 40 sabres, 4th Bengal Cavalry, and a few British signallers.

On night of attack garrison was increased by 150 men of the 31st Bengal Native Infantry, who had halted there *en route*.

At 11.30 p.m. the enemy appeared suddenly in great numbers on a plateau about 150 yards distant, and making a rush, gained the cover of the fort wall, when a hand to hand contest ensued. In a few minutes, however, the whole parapet was manned, and the British Infantry fire became so hot that the enemy retreated, carrying away all his dead and wounded, except six. British loss—1 officer and 7 men killed, 19 men wounded. 19 of the garrison were wounded by sword cuts.—(*Intelligence Department Account*).

In the former instance, it would at first sight appear to be clearly established that there is no need for "obstacles" under such conditions, for nothing could exceed the resolution with which the attack was made, and yet it failed, even though the troops were able to advance to within 100 yards of the defending line in close formation, and the fire of the defenders is not comparable to that from modern magazine rifles. But it should be noted that the attack was made on unshaken troops, equal in numbers, whose artillery had not been silenced, and that there was no quick succession of wave on wave of attacking troops, such as is contemplated in modern attack formations, but the mere thrusting forward of an isolated brigade to win or lose by itself. If under such conditions they were able to struggle forward so far, "that 40 yards from the wall the dead and dying lay piled in heaps," it would hardly seem safe to abandon as useless the aid afforded to a defender by the use of obstacles, especially if it is found that night attacks become a regular feature of battles.

The other instance marks most clearly the need for the use of obstacles in such positions, if they can possibly be made. Instead of fighting under such conditions, that their superior arms would have

given them every advantage, we find the British garrison engaged hand to hand and suffering serious loss; the loss of the enemy being probably confined to the 6 dead and wounded left behind.

In the case of battle-fields, it must be to the interest of the enemy to make a vigorous and concentrated attack on some point or points which he considers weakest, or the capture of which will give him the most decisive results. In defending these points no sources of strength should be abandoned, and under ordinary circumstances obstacles do constitute a source of strength, though it may well be a question whether time and labour are first to be devoted to them or to other works.

Before dealing with the details of obstacles, it is well to consider the conditions which they must comply with. The chief are—

1. Not to give cover or screen to the enemy.
2. To be within effective range of line of defence.
3. To be easily made with the means available in the field.
4. To be effective in detaining the enemy under fire and breaking up his formation.

The first is obviously a necessary condition, as a clear field of fire is of even more importance than an obstacle.

As regards the second condition, it is generally laid down that the obstacle should not only be within effective range, but it should not be too close to the line of defence, as it is damaging to the *morale* of the defenders to see the attackers in very superior force quite close to them: between 100 and 300 yards from the line of defence is generally considered a suitable position for obstacles in battle-fields.

The other two conditions require more detailed notice. There is, I think, too much tendency to judge of obstacles as regards the impediment they offer, not to masses of men, but to individuals, and judged by this standard, such an obstacle as "shallow military pits," especially when estimated by the obstacle formed by a few constructed for peace training, seems trivial and useless; even the ordinary form of wire entanglement seems hardly sufficient, and there is a craving for such elaborate "forms" as the barbed wire entanglements of our text-books. But the conditions of war are very different. We must picture to ourselves the attaching line gradually made denser and denser by wave after wave of reinforcements as it approaches the line of defence; for it is difficult to conceive how the attack can finally advance to the shock in the face of a resolute enemy standing shoulder to shoulder under good cover, unless they are themselves, not merely shoulder to shoulder in single line, but in more or less of masses; for we know that the feeling of being in a mass lends force to an attack. It is to such a mass that our obstacle is designed to form a hindrance: a mass burning to cross the small space intervening between them and the enemy, and to put a stop to the awful fire: and it need not be an obstacle calculated to stop an individual that will break up the formation of the mass, throw it into confusion, and check it under deadly close range fire. If it can be arranged that the enemy shall come suddenly on an unexpected obstacle, the effect is much increased. And no detail is

too trivial that helps to effect this. Thus, in constructing wire entanglements, freshly cut tops of the pickets should be soiled with earth to prevent their showing white.

The obstacles most easily formed under normal conditions are shallow military pits (at least 15 feet wide), as no materials are *necessary*; but unfortunately, they take a good deal of labour. They may be improved by stakes, and still more by a simple wire entanglement. Abattis, whether of trees or of boughs in several rows, form a good obstacle; and it may here be noted that all the experience we have goes to show that abattis cannot be injured by artillery fire, even by heavy artillery fire. (On the occasion of our first attack on the Redan, the abattis were found practically uninjured, even after the heavy bombardment that had gone on). Inundations and other more elaborate forms of obstacle may be used when time and means allow.

The question of clearing the ground must always be considered in connection with the use of obstacles. It used to be laid down as a rule that all hedges, fences, walls, etc., parallel to the line of defence should be cleared, while those perpendicular to the line of defence should be left as being calculated to break up the attack, impede effective command, and prevent complete co-operation against counter-attacks. As regards the hedges, etc., perpendicular to the line of defence, there was good reason for the rule as long as movements in attack could be made "in formation," and while the range of weapons was comparatively limited; but the greatly increased range of modern weapons enables flanking fire to be brought to bear from great distances, and as attacks are now made in looser order, it is no longer advisable to have lines perpendicular to the line of defence which might shelter from flank fire, the advantage of breaking up the lateral continuity of the attack being no longer of such great importance. All *cover* parallel to the line of defence must of course be cleared, but it is a matter for consideration whether such obstacles as hedges, which do not protect from fire, but which form a very serious hindrance to the advance of the attack, should be cleared. I have already strongly urged the advantage of a screen from sight, where absolute protection from fire cannot be obtained, and I have pointed out the moral support it gives. So far as the hedge affords this to the attack, it is a disadvantage to the defence; but where a hedge is not so thick as to screen from sight, a condition often fulfilled when there are no leaves on it, then I would ask you to consider how you would yourselves propose to get a fairly thick line of attack over a moderately stiff hedge. The probability is, that recourse would have to be made to gaps and gateways, which means that men would be got forward with difficulty, and the defence could concentrate their fire: supports and reserves would, if they are to be kept in any sort of formation, afford a good mark to the defenders when passing through gaps and gates; in any case, time would be lost, and time is generally an advantage to the defender.

Clearing the field of fire generally progresses with the preparation of obstacles, and even in face of the general condition "that the obstacle should be under fire," it is sometimes desirable to fill in

hollows of ground with felled trees to prevent their being used to shelter large bodies of the enemy within a short distance of the line of defence. It has occurred to me that a "burning" obstacle would be effective in such cases, provided smoke was not produced in sufficient quantities to hide the enemy.

A somewhat different treatment is necessary in preparing obstacles for the defence of encampments or isolated posts, such as that referred to in the second instance quoted. In such cases the obstacle should, if possible, be effective even against individuals; it should be very much nearer to the line of defence, as it might otherwise be crossed, removed, or destroyed at leisure under cover of darkness: for it is often impossible, especially in savage warfare, to maintain sentries outside the line of defence at night; the existence of an obstacle quite near the line of defence will often be a means of obtaining "notice" of the movements of an enemy, and it will break the rush of determined savages. Short stakes set close together, inclined towards the enemy and pointed after they are driven, form a most formidable obstacle: formed of bamboo, with sharp edges as well as sides (to make them difficult to grasp to draw out), they are much used by hill tribes in India, and are known as panjies.

General Preparation of a Battle-field.

Limits of time prevent my dealing at greater length with details of defences, and I now propose to attempt to deal briefly with some of the points that arise in connection with the general preparation of a battle-field.

First, we should, I think, consider what the attacker would desire to do. Briefly stated, I think his first requirements are, to be able to deploy his artillery safely within effective range of the main defensive position, and to be able to bring up the bulk of his infantry in column of route to his artillery position. He would then be able to draw the fire of the defenders from the main position, and could systematically dispose of his infantry for the attack.

To compel him to show his hand earlier, to bring his artillery into action, and to deploy, and thus to some extent lose control over some of his infantry at a distance from the main position, the defender resorts to advanced posts. The main point to be borne in mind in preparing these is, that they are not intended to be held too resolutely; there is always a danger in connection with the use of advanced posts, that a too resolute defence may lead to a difficulty in withdrawing the defenders, and then eventually, to the battle being fought in the advanced position, instead of in the carefully prepared position in rear. The fortification of the advanced position would, therefore, chiefly consist in the utilisation and adaptation of existing cover; care being taken to provide full facilities for withdrawing the troops from their position readily, and to arrange that the cover provided shall be of as little use as possible to the enemy when evacuated. The conduct of the defence of the advanced posts sufficiently long to force the enemy to show his hand to some extent, without too seriously entangling the troops, is rather a tactical than an engineering matter, and I will not refer further to it. But I would point out that the modern rifle enables

a few troops to make a very considerable resistance up to a certain point, and therefore advanced defences will probably only have to be constructed for small bodies of troops.

We next come to the defence of the main position. The choice of the position would probably not depend entirely on its suitability from an engineer point of view, but partly on other considerations. But, given, the position our practice is, not to attempt to make it equally strong, and therefore equally weak everywhere, but to pick out certain points well suited for defence, and devote our time and labour to rendering them as strong as possible: the idea being that an enemy cannot penetrate between the strongly defended points until he has captured them. We believe that the infantry of the attack are naturally drawn to act against those portions of the defensive line, from the fire of which they are themselves suffering most severely; that it is the natural instinct of the infantry soldier to reply to the fire that tries him most; and thus, the more strongly we defend our strong points, the more certainly will they draw the attack of the enemy, because success can only be attained by their capture.

In accordance with the principle of looking first to existing cover, we occupy villages, woods, and special features of ground when they are suitably placed; and when they are not so placed, or are not to be found, we then resort to the construction of field redoubts where time and the soil allow it.

In undulating country, like much of our English country, villages are frequently situated in valleys, and are commanded by ground in close proximity; their situation being often determined by the convenience of water supply. In such situations they cannot well be utilised as the strong points of a position; but where they are on unfordable streams and command bridges, they form admirable advanced posts. In open and comparatively level country, villages are most valuable as "strong points." Their advantages are, that there is a large amount of cover already existing, not only for shooting lines, but also for supports and reserves; that the troops occupying them are well sheltered from weather; that water and fuel, and often food and forage, are readily procurable; and that a certain quantity of tools and a good supply of materials are likely to be available for the construction of the necessary "works." However little time is available, it can be usefully spent in improving a village for defence, and all work done on it is work to the good.

The increased power of Field Artillery has rendered the occupation of houses as a first line of defence very undesirable, and we now look to occupying the enclosures of the village for our shooting line; for although, as against earthworks the common shell of Field Artillery has very little effect and need not be seriously regarded, against houses the case is different, and even shrapnel is likely to have serious effect on troops in houses of ordinary construction. For this reason, troops in support or reserve are generally placed behind, rather than inside houses.

The preparation of the enclosures of a village for defence does not require further notice here; but I would point out that, in proportion

as there are many and small enclosures, there is the more need for a very carefully prepared system of communications for the defenders. One of the first points to be attended to is the barricading of the main communications of the village against penetration by the enemy ; but an equally important point is to arrange for free communication throughout the various parts of the defensive line : this enables the reserves to be brought up at once to repel the enemy at any point where they have penetrated. The importance of proper communications is not always fully realised, and particularly in peace manœuvres. In large villages, in particular, it is specially important, not only that proper communications should be prepared, but that they should be thoroughly known to those who have to lead troops : a free use of signboards is often desirable.

Although the occupation of houses as a first line of defence in the face of artillery fire is no longer desirable, they can be usefully employed as second lines, or as "keeps," wherever they are screened from distant artillery fire, either by trees or by other buildings. A very broad distinction must be drawn between the effect of the concentrated fire of a large mass of artillery on exposed buildings and that of one or two guns brought up with great difficulty into a village, the outskirts of which have been captured, to attempt to deal at short range with defended houses in the interior: it seems probable that guns could not be served under such conditions in the face of rifle fire.

In selecting buildings for defence as a second line or as "keeps," it is of course desirable to arrange that they shall have a fair extent of cleared space in front of them, and that they shall be "strong" buildings.

Time does not allow me to go into the detail of the preparation of houses for defence, and I would merely observe that the two important points to be considered are, that they shall, as far as possible, be protected from the danger of catching fire, and that they shall be well calculated to resist the enemy breaking into them.

It is sometimes urged against villages being utilised for defence that the troops are very much broken up in them ; but, on the other hand, they take comparatively little labour to place them in a state of defence.

Woods are also readily placed in a state of defence, and afford good cover for supports and reserves. It is generally laid down that when troops are so far inside a wood that they cannot see daylight between the stems of the trees, they are safe from fire. The preparation of proper communications is a matter of much importance, and may involve a good deal of labour. In Canada, it is considered that 8 skilled men will fell and lop an acre of forest in a day ; but as this does not allow for removal, and as skilled woodman must not be counted on, at least twice that number must be allowed, and it will be wise to provide about 20 men an acre. The preparation of good obstacles in connection with the defence of a wood is an easy matter, and a good second line of defence can be made with a comparatively small clearing in front, because very formidable obstacles can be prepared in connection with the clearing. Existing open spaces in the wood should be utilised if possible. Arrangement of the obstacles in regard to the communications for defence requires careful consideration : it is usual to make the obstacles

"radiating" to some extent in order that bodies of the enemy, penetrating into the wood, may be broken up and laid open to attacks in flank.

It is difficult for an attacker to fight a decisive action *in* a wood; his object must be to push through as rapidly as possible to the further edge: well arranged communications, good obstacles, and a strong second line of defence will give the defender every advantage in repelling inroads that may be made in portions of his line.

In open country, where there is no existing cover suitable for placing in a state of defence, field redoubts are constructed to furnish strong points in a position. Their main disadvantages are, that they require much time and labour to construct, and when provided with bombproof cover, they require a large amount of timber and other materials; that they only furnish a small front of fire, and that until nearly completed, they are not of much use. The garrisons they hold cannot generally construct them within the time that may be considered as likely to be available. But strong field redoubts afford excellent shelter to their garrisons from fire, and with magazine rifles and machine guns, a much larger volume of fire will be obtained from them. It is essential that ample means of exit should be provided from the bombproof cover, in order that the parapet may be quickly manned. I cannot now go into the details of the design of redoubts: where they are used there will generally be some Engineers available for laying them out and superintending their construction: the proper arrangement of working parties requires some care and experience. Under ordinary circumstances, it is well to start with a simple design, which can be carried out within a short time, but which can be developed easily if more time and the necessary materials are available.

Good field redoubts have an appearance of strength which is morally favourable to the defenders, but the disadvantages stated above are sufficient to prevent an extensive use of them, except under special conditions. In the case of Plevna, the great modern instance of defence by redoubts, "existing cover" in the shape of villages, woods, enclosures in suitable places, was markedly absent and time was not limited. A great absence of "obstacles" is to be observed there, probably due to want of materials.

In conclusion, I would say that in preparing a position for defence it is of the utmost importance to decide rapidly on the general lines of the scheme of defence, and to tell off the troops to their several sections as soon as possible: the officers charged with the supervision of the work should arrange for the immediate collection of all tools and materials, and of such labour, horses, carts, &c., as can be obtained locally. As far as possible, the troops should be set to execute, under their own officers, such work as they will have to defend. It must be clearly understood it is no matter of the troops having to work "for the Engineers," but that Engineers are only there to help them, to the extent that their small numbers will allow, in preparing by their own labour works suited to their own requirements, works which, having constructed with their own toil, they should be the more resolute to hold with determination.

(Conclusion.)

NAVAL ATTACK OF FORTIFICATIONS.

BY

CAPTAIN H. J. MAY, R.N.

(Lecture delivered at the School of Gunnery, Shoeburyness).

PART I.

Gentlemen,—I am afraid I have nothing very new to tell you this afternoon. This subject has been very thoroughly dealt with by more competent men than myself. From a shore point of view, I dare say you have read what Major Lewis, Major Clarke, and many others, perhaps more able, have written; and from a naval point of view, all I wish to say this afternoon has, I think, been better said by Captain Jackson before the Royal Engineers, his paper being printed in their "Proceedings" in the year 1889. But still I saw the other day in the newspaper something about "the vexed question of ships *versus* fortifications;" so I suppose there are still some people who have not quite made up their minds upon the subject.

If you will allow me, I will wander for a minute or two into the domains of strategy. One of the vexed questions I believe is, What does a ship want to do? What we want to do, in a very few words, is to obtain command of the sea. That is the main objective of all the fighting force afloat. By that we mean, not that we shall sweep the seas completely clean of every foreign ship, but that no hostile ship shall be able to remain at sea without being encountered by a superior force, and destroyed or driven into port; and that a hostile expedition runs its greatest risk whilst at sea, and is sure to be overwhelmed if it is delayed by only a moderate amount of resistance on the coast long enough for the superior fleet to come up. If we obtain the command of the sea, we shall want, I think, little more.

Still, fortifications exist, and you will say, Are the fortifications no good? I think the fortifications are of decided use, because, supposing that we do completely sweep the sea, then comes the question, Where do we sweep the sea to? Well, those ships which have fled from us at sea will escape into fortified harbours. From the experience of old wars, I believe we shall find that those ships will remain in those harbours, and that we shall not be able to get at them; and because there are fortifications they will be able to come out in twos and threes, and very much annoy our commerce. So that I do not think that any

attack on fortifications is likely unless those fortifications shelter ships, which ships you think will come out and do you more harm than the harm you will receive in attacking them under their fortifications.

Briefly, I think that no fortifications need exist unless you want to shelter ships. I cannot myself see that fortifications can possibly prevent an invasion, for it would be impossible to put a Chinese wall around the whole country. So that fortifications must be looked upon as sheltering ships.

Now, when you come to the question of attacking fortifications, a very different state of things prevails from that for which the ships are built. I have here a diagram of one of our first-class battle-ships, the "Rodney." She is one of the much-abused "Admiral" class, but I do not think she is a bit worse, and she is probably considerably better than the foreign ships which were built at about the same time; and being a barbette ship, as most foreign ships are, she fairly respesents the average iron-clad. We call her an armoured ship: there is not very much armour about her, but it weighs an immense deal, amounting to something like, I think, one-fifth of the whole weight of the ship. As a matter of fact, it is a very difficult thing to protect a ship; and when I say "a ship," I include all that part of the ship which is essential to seaworthiness. We have, of course, fighting ships—"Monitors"—which hardly show above the water; but the great drawback of the ships of the "Monitor" class is that they are unseaworthy. Many of the "Monitors" went to the bottom (as the original "Monitor" herself did) because they were not fit to go to sea. For going to sea we must have a ship with considerable freeboard—the "Admirals" have not half enough freeboard as it is. Then we must be very careful to armour the water-line, so that the water will not get in. In the case of the "Rodney," we have put a certain thickness of armour on the water-line, and an armoured deck over it, all this to make her seaworthy: after that, we have very little protection left for the guns. We have two barbettes with a pair of heavy guns in each, but all the smaller guns are altogether unprotected. They are in about the same position as if you brought a Siege gun into action without building any kind of battery at all; and nobody but a madman would think of bringing a Siege Battery into action, even against an incompletely or partially armed place, without any parapet. So that you see the only guns that can fairly cope with forts are these barbette guns, and even those, when you see them in their loading position, are very much exposed to fire. They can only load in their fore-and-aft position, and if you want to fight on the beam, they have to be trained round to load every time.

The net result of all this is that I do not think we shall willingly risk our best ships against forts, and no ships but our best ships are fit to stand up to fortifications.

With regard to cruisers, if you simply take away from the "Rodney" all this belt of armour and the barbettes with their guns, and thin down the armoured deck to about half its thickness, then you have left the 6-inch guns unprotected. Instead of the big chase guns, put one unprotected gun fighting fore and aft respectively, and there you

have a first-class cruiser which is evidently much less fit to cope with fortification than the "Rodney."

But you will say to me, Have matters changed so much? People are building coast defences: what are they all for? Will they never be attacked? Well, I think there are some cases in which we may attack coast defences, and I will give you some conditions which I think may make it necessary.

First of all, it may be necessary to engage batteries when some strait or narrow passage, through which it is most desirable that your fleet should pass, is in the hands of the enemy, and is blocked by shore defences. There was a notable instance of that in the American war. It was most necessary for the Northern fleet to obtain possession of the Mississippi, because the Southern ships had command of the river, which is, you see, in some respects similar to having command of the sea; so that it was necessary to introduce Northern ships into that river, with the view of wresting the command from the Southerners. The entrance to the river was barred by the forts at New Orleans, and it was necessary for the Northern fleet to attack the forts to force the passage, which they did successfully. They were then able to get at, and overpower the Southern ships.

Again, it may be that the defences shelter with their guns the enemy's ships—either men-of-war or merchant ships—which it is considered necessary to destroy; or, that although but few ships are sheltered, the establishments protected by the works are capable of building or equipping ships, and thus are likely to exert an influence on the command of the sea. In these cases it may be necessary to engage batteries. A notable instance of this was Nelson's attack on Copenhagen. We did not want the Danish fleet arrayed against us, and it was considered worth while to go in and smash the Danish fleet before it could put to sea and do us any harm, notwithstanding the forts by which their ships were protected. But the forts at Copenhagen were not very strong, and we did not wait till they became stronger, but went in at once. Another instance occurred in the war of 1812, in the American lakes. There was some very pretty fighting there on a small scale for the command of the lake. Each side had a dockyard, and built ships as fast as ever they could. The dockyard that built ships fastest put the most ships at sea, and that side, speaking generally, obtained the command of the lake. When they had fairly swept the lake, the next thing they did was to destroy their enemy's dockyard, so that no more ships might issue from it, and then they held command over the lake. But it did not last long: the dockyard was always rebuilt after being destroyed; more ships were built, and then came the fight at sea over again.

Thirdly (but this only in a small degree) it may be necessary to engage batteries when shore defences command waters which it is wished to occupy, either temporarily while a force is being landed, or permanently in order to secure the port for your own use. Perhaps an instance of that which I may quote was Lissa; but the island of Lissa was not attacked, I think, for any rational reason, but because the good people of Italy thought that their fleet ought to do something,

and they absolutely forced the Admiral to attack Lissa, though he did not want to do so, and that ended in the miserable fiasco which one might have expected; but still his aim was to take Lissa for itself, and not because it was exerting any influence on the war.

The fourth instance in which it may be necessary to engage batteries we have had some instances of lately, viz., when it is considered that the bombardment of the works themselves, or of the town, is likely to produce an adequate effect, either moral or material. Of that we had a notable instance at Algiers, and perhaps a more notable instance than any other. We wanted to produce a moral effect upon the Moors rather, I think, than to destroy their ships. We went in and smashed their forts, and the moral effect was so great that on the following day they gave in to all our demands. Very much the same thing happened at Alexandria; we knocked the forts about a bit and frightened the Egyptians very much, and in the night they all ran away. But we cannot always count upon the gunners being so much frightened as the Egyptians were; so that I do not think that is altogether a safe precedent to follow.

I will come first then to what I think is the more feasible operation, the operation of forcing the passage of a channel. One of the difficulties about it is, that there are not many channels to force; I do not think that there are half-a-dozen in the British Empire, because it is a necessity of the case that there should be something for the fleet to do as a fleet beyond, and that when they get beyond the fortifications they should have matters fairly their own way. Of course, we know the case of the Dardanelles; that is an instance which is always before us, and there are other instances of the same kind in which it is advantageous for a fleet to run past forts and then to operate in the waters beyond them. And, now, if you will allow me, I will describe what I think would be the kind of operation which would be carried out in the way of forcing a passage.

First of all, it is our great idea to get the ships past quickly. We do not want to fight the forts. If the gunners would kindly go to sleep we would run past them in the night and have nothing to say to them; but I am afraid we cannot count upon that. On the other hand, the object of the defences is to stop the ships, or, if they cannot stop them, to delay them so much that they will be so knocked about as to be unable to carry out the work that they wish to do beyond. So that it appears to me that obstructions are more important in these cases than guns. We had a notable instance of that—our failures on the Peiho River; we had run our gun-boats up those Chinese rivers several times past forts; we had fired and the Chinese fired, and it generally ended in the Chinese running away, and in our going up the river. But in 1859 there was an expedition up the Peiho River; there was an ordinary fort, but there turned out to be rather an extraordinary obstruction. When the gun-boats got so far as the fort, they found that the obstruction was barring the way. They said, "We will knock down the fort," but they did not succeed in knocking down the fort, whereas the fort succeeded in knocking the gun-boats about very much. The gun-boats then began to find that they had too much

of it, and the only thing left for them was to withdraw. Had they gone for the obstruction, it is quite possible that they might have got past it and succeeded, and although the forts were important, in that they beat the gun-boats, still the obstruction was more important, because it kept the gun-boats in front of the forts. So that our first object must be to get the channel clear, and if the channel is in constant use, as the Dardanelles would be, as the channel will be if it is worth calling a channel (because, supposing that a channel leads to nowhere and nobody comes from it, it is scarcely worth fighing for), I think it is possible by means of a surprise to find the channel to a great extent unobstructed. I do not know very much about the latest inventions in the way of mines, but I do not think that it is possible to keep such things as contact or mechanical mines about any channel which has to be used constantly.

Then there is a question of observation mines. It is possible that they may be laid and kept there; but then they get out of order, and so it appears to me that the great thing to arrange for is a surprise. But we must not have a surprise on both sides. It was an utter surprise to Farragut, I suppose, when he went into Mobile and his leading ship was blown up by a torpedo; but that is not the surprise I mean. We must first send a few boats to see what the channel is like and how it is obstructed, and we shall find it most necessary to know all about the place, and that we can scarcely find out in war time; we must do it in time of peace. We shall have to study carefully all the channels which it is possible we may have to attack, and in war time we shall have to catch the pilots who know the channel. We shall also in peace time have to study what has been done with a view of blocking that channel, all of which will give us useful information as to the sort of resistance which we are likely to encounter. Our reconnoitring force, consisting perhaps of a couple of cruisers and half-a-dozen gun-boats, mainly fast boats, with perhaps torpedo boats, will run in, and if they come out and report that the channel is sufficiently clear to go on, then we might go straight through. But supposing we find, as I fear we shall, serious obstructions in the channel and the people on shore more or less awake, then we shall have to attack the obstructions. That means bringing up a number of small craft, and those small craft are very troublesome, because they will not live at sea. You may, therefore, have a subsidiary piece of fighting in seizing a base where all those small craft could be collected, and when you have got your small craft together, then comes the fight. Now, in the case of England, we arrange our coast defences in such a way that the small craft which I think would do this work best do not all belong to the Navy, but some at least belong to the Army. I mean the small craft which must more or less act as a defence for our own harbours, and which lay submarine mines, &c. But if the attack was made upon us, I have no doubt that a Continental Admiral would requisition those small craft who are themselves in the habit of laying down mines and getting about at night in narrow harbours, and who know how to navigate intricate waters. When you have collected this flotilla as quickly as possible, then they would have to go in and

clear the channel; and I do not myself see how we can support those boats. I am afraid they will have to go in as a sort of forlorn hope with their creeps and their counter-mines and their various devices for clearing the channel, and will have to run the gauntlet of the guns, because if, as is sometimes advocated, we advance our ships to support those boats, we bring on just what we wish to avoid. We want to get our ships past clear and yet we rush them into a fight, and perhaps anchor them under the guns of the batteries, which is just what the batteries want. So that I think it is quite possible that the beginning and end of forcing the channel may be that the small craft will try to force the obstruction and may be driven back, and perhaps after all the game may be considered not worth the candle; but, at any rate, there will be fighting of some kind over these boats. The boats, of course, will try to get darkness or fog in their favour. Supposing the channel to be fairly narrow and the electric lights to be about, and the electric lights to be well worked and well managed, then I do not think that the darkness helps the boats very much; but if the place is a foggy one, fog helps them a good deal, because it altogether obscures the electric lights and upsets the gunnery on shore. The only thing that they then have to fear so much is counter-attacks from boats like themselves. But I do not myself think that you can work both guard-boats and the guns, you must have one or the other. If the weather is clear I fancy the defence had better trust to their guns and electric lights and sink or disable every boat they see. If the weather is thick, cease firing and hunt the place over with your own guard-boats. What you want in order to keep those boats off, I take it, is not well defended batteries, not thick parapets, but a lot of little guns—quick-firing guns if you can get them,—but if you cannot get quick-firing guns, field guns or old 40-prs., or anything that will sink a boat, and that does not require much.

Now, supposing the channel to be clear, the people on shore immediately set to work to fill it up again, and that, I think, is where mining will come in. It is very easy, as you know, to run a line of counter mines, and it is just as easy to run a line of mechanical mines, and when the channel is cleared the enemy, if he is worth much, will immediately stick a lot of mechanical mines down and perhaps make the place worse than it was before. Therefore, all these boat operations must be so timed as to close as daylight comes on, so that we may be pretty sure that the enemy are not putting down more mines. When once we get daylight the big ships will go in. I cannot myself see the least chance of big ships going into a narrow channel at night. Ships have gone through a channel at night. Farragut did so at New Orleans, and they ran past Vicksburgh, but there were no electric lights in those days, the gunnery on shore was not very good, the channel of the Mississippi was perfectly clear, and they went so slowly that if they got on the mud they did not stick. The best proof that daylight is best is, that Farragut himself, towards the close of the war, chose daylight to run into Mobile. Mines were just beginning then, and he lost one ship by a mine as it was. But we must have daylight to see our way through the obstructions, and we cannot

navigate ships when the electric light is about without standing a very good chance of their running on shore, and if a ship runs on shore in a place of that kind, of course one would not give much for her. So that I would make my run in early daylight. I would rig out from my ships nets, and what have been irreverently termed cow-catchers or dredges, to keep off contact mines, and one must have a good flotilla of small craft to hunt everything in the semblance of a torpedo boat. We must go in line ahead. The clear channel will not admit of anything else. To lead, I should not put a ship of the "Rodney" class, but probably some of our more old-fashioned iron-clads, in which the guns are better protected and the ship in many respects not so valuable, so that if you lose her you will not mind so much. Still, if you are going to run past a place you cannot altogether pick and choose your ships. When they were running into the Mississippi, of course they had to take with them river gun-boats, because the work up the river necessitated that kind of craft. The river gun-boat is not at all the kind of craft that you would take to run past a fort if you had your choice; and, speaking generally, the ships will be those that are required for the particular class of work beyond the forts. However, if there is a choice, I should put moderately old iron-clads in front, then might come, perhaps, our best ships, then the weakest ships, and lastly a few iron-clads with good stern fire, with everything ready in the way of towing hawsers, &c., to pick up any stragglers in the rear.

With regard to firing, the main object of the ships being to get through, it would be, I think, a question as to whether all the unprotected guns should be manned in the leading ships. Perhaps, in ships of the "Rodney" class, it might be as well to keep the men belonging to all the unprotected guns under cover until you got fairly close to, and then to let them go up and fire; but, at any rate, our firing would not be directed towards destroying the batteries or even towards disabling them, but towards slowing the fire of the batteries in any way, principally by firing at people who were exposed. We could hardly expect to hit the very small target which a gun represents, but still, with the quick-firing guns and machine guns, and so on, we might make their fire slower and wilder.

We should also keep a very good look-out for anything in the way of observing stations for range-finders. I have not the least doubt that foreigners have plotted down on all their charts our observing stations, because they are not very well hidden away; and, in the same way, anything that looked like a torpedo station or a station from which anybody was directing fire. Plans of all the forts would be most necessary, and also, if we could get them, photographs. If those boats could run in in the way I have contemplated, of course they could take photographs, and it would be very useful to have photographs to point out to us just where the places were which ought to be fired at. At Alexandria, I myself fired an electric broadside at what I afterwards found was a lot of old smooth-bore guns, because I had neither the time nor the opportunity to make sure that they were not rifled guns, and so the whole of that broadside was thrown away. We must carefully study all the works, and then each ship must be told what to

fire at. A very notable case of success in that way was Porter's action with Fort Fisher. He made very elaborate plans of what each ship was to fire at as well as the position of each ship, and the result was that the ships got off very easily. I may say a word or two afterwards on the attack on Fort Fisher; but as regards safe-guarding the ships by the amount of their fire, they managed that very well.

Now, supposing that ships can run past in this way, of course the main question is if the channel leads to nowhere, where the ships can act as ships, as is the case here in the River Thames, is it worth while running past and getting into a *cul de sac?* I do not think it is. This sort of thing would never be attempted unless, as I said before, we had some objective beyond. But I go a little further than this. Supposing that it is possible for boats to get past the obstructions, I think it may be found that boats may very possibly do all that the ships can in the way of destroying ships in the harbour. Should this be so, then that is the kind of attack that you are likely to have to meet. Take Portsmouth Harbour, for instance, the fleet lying at Spithead: it would be a great thing for the enemy if he could sink two or three of those ships, it would be of no use his sending his ships in to do that because they would get so knocked about that the loss would balance the gain; but supposing that it were possible for boats to get in, those boats would run in with torpedoes and do everything that the ships could do, and something more. So that the only kind of attack which is likely to be made is an attack for the purpose of clearing away obstructions sufficiently to let boats pass. That done, they will try and slip past with their torpedoes, and even if only half the boats can get through, it will be well with the loss of the other half, and I cannot see how you can meet this kind of attack by the big guns of which we have so many mounted now. I think we want more of the small guns, we want more passive obstructions, perhaps artificially narrowing the channel by some kind of improvised floating batteries or booms—booms are unreliable things, because in many places they would get washed away; but you might have some old craft fitted up as a floating battery which would support a long boom and prevent the boats coming in: and although you may say that such craft would easily be sunk by a ram, as no doubt might be the case, yet it is not half as easy for a ram to get in as it is for boats to get in.

I would conclude this lecture by saying that I think in guarding a channel the thing that you have to look out for most is to keep out the small craft, and if your arrangements are such as to keep out the small craft, the big ships will never come in and will never give you any trouble.

(To be Continued).

EXPERIENCES AT OKEHAMPTON IN 1891.

BY

CAPTAIN W. L. WHITE, R.A.

(A Lecture delivered at the Royal Artillery Institution, November 4th, 1891).

COLONEL C. C. TRENCH, R.A., DIRECTOR ARTILLERY COLLEGE, IN THE CHAIR.

BY permission of the Commandant of the School of Gunnery and of the Camp Commandant Okehampton, I am enabled to place before you some of the principal results and some of the points most worthy of notice of the practice at Okehampton in 1891.

The points which were noted in the report for 1890 (of which my paper of last year read in this theatre was the pale reflection) and to which attention was drawn in the "Instructions for Practice, 1891," naturally attracted the attention of Battery Commanders and a marked improvement took place in almost all the points brought forward. I shall, therefore, this year, endeavour to bring under review other phases of the practice, which want of time, and the fear of making the paper too long and wearisome for the "Proceedings," forbade me to mention last year. There are two or three points from last year's paper, however, that I must venture for a moment to dwell upon, viz. :—

Distribution of fire, though greatly improved, is not yet what it should be, nor will the best effects be produced in the shortest time until the fire is distributed from the first shrapnel, or, in the case of continuous fronts of target, from the very first round. We must not allow our views to be narrowed by the unreal conditions of the practice ground, one of which is the want of moral as well as material effect produced by the bursting shell of a well distributed fire, an effect which would be postponed, perhaps never attained, if we confine our fire too long to the ranging point; at all events our men must suffer the more from the undisturbed fire of the enemy the longer it is undisturbed.

Fuzes.—The controversy as to whether it was better to get the first time fuzes to act on graze or in the air ran high this year. Some officers said that they TRIED to get the first fuzes to act on graze;

surely, as the quick arrival at an effective time shrapnel fire is our great object, one should TRY to get the first fuzes RIGHT and not postpone the wished-for moment by preliminary operations; unless the indistinctness of the target, or other reasons, render such proceedings necessary.

While speaking on the subject of fuzes, it will interest you to know that, working from a very large number, some hundreds, of fuzes, it has been ascertained that the mean error of the fuzes of a well-trained battery is as follows :—

Range. Yards.	Mean error. Yards.
600 to 1000	18
1000 to 2000	19
2000 to 3000	19·5

With these figures as a point of reference, if any officer will take trouble to work out the mean error of the fuzes of his battery, he will not only be able to see the result of the training that his men have had, but most infallibly to find out at what guns the fuzes are badly set.

As showing the result of the high velocity of our gun on the burning of the fuzes, I am permitted to mention the results of firing with a charge of 12½ oz. of cordite, giving a muzzle velocity of 1537 f.s., in which the mean error of 27 fuzes, at ranges between 2100 and 2600 yards, was only 12·7 yards.

An old complaint has cropped up again this year under a new form. It was remarked of the batteries practising in 1889, and referred to in the "Instructions for Practice of 1890," that there was *too much exposure in taking up positions*. It was noted that in 1890 there had been a great improvement in this respect, but it has been a remark frequently made this year, that the calling of the sectional officers and gun-layers to the front is an unnecessary revelation of the spot upon which the batteries are eventually to come into action.

This is a question of such very great importance that it deserves to be treated somewhat at length. The German Regulations go so far as to say that, "after the simultaneous opening of fire on the occupation of the first position in action, the thing next in importance is the occupation of a preparatory position under cover," from which the preliminary reconnaissance of the target may be carried out before the battery is committed to action.

Those by whom I have most often heard the indictment preferred have generally been standing with the range party at a higher elevation than the target and well to a flank, they were, therefore, enabled to look both over and round the folds of ground covering the battery from the target, hence I am inclined to think that in many cases where batteries are said to have exposed themselves unnecessarily they were not really so exposed to an observer at the target itself.

Again, the ground at Okehampton is exceptionally open and also, the spectators, knowing exactly where the batteries were coming into action, were on the keen look-out for any appearance on the bare hill-

side, where the slightest movement against the sky-line could hardly escape notice.

But, even setting aside these excuses, we cannot afford to do without calling forward at least our sectional officers before committing the batteries to the FIRST artillery position (when possible it is desirable that the gun-layers should come forward too). Be it remarked that it is not claimed to be of such importance in positions other than the first; to begin with there would probably be neither time nor opportunity for it during the latter phases of an action, and also, as everyone is by that time familiar with the task before him and much of the pointing out of target and giving of instructions can be done before the batteries leave their previous positions, there is also no great necessity for it. In the case of Horse Artillery acting with cavalry there most certainly never would be time for this proceeding, but, nevertheless, it should be sedulously practised by them; since the greater number of Horse Artillery batteries are employed with the Corps Artillery and not with the Cavalry Brigade.

The argument in favour of it is this. The batteries are about to engage in a duel with those of the enemy, in which one or the other most certainly will be silenced, if not quite disabled from loss of *personnel*. Why then go into action without having taken every precaution to ensure success? No man can say that it is not far easier for a Battery Commander to point out the target to his sectional officers and gun-layers grouped round him, than if they were standing in battery, perhaps under the fire of the enemy. The time that this pointing out takes is of no moment as compared with the advantages gained. What is the value of four minutes (the average for this year was three minutes 41 seconds) in a fight that must last at least an hour, perhaps more, when by a proper use of that four minutes we may secure a manifest advantage over the enemy; especially when we consider that some of the batteries may be waiting some time under cover while the others are closing up and massing to the front, which time could not be employed more advantageously than in making known to those most concerned the task before them.

This year, as last, shows a *great advance in fire discipline* and this is undoubtedly owing to the introduction of silent drill, which has "caught on" to a most wonderful extent. Indeed, since its adoption I have heard officers, not only of our own branch, but also those of other arms, declare that they now thoroughly appreciate for the first time what a terrific weapon a well-managed battery is, so completely can it now be swayed by its commander. Such being the case, we are now in a fair way to combat one of our most pronounced failings, namely, the difficulty of turning fire rapidly from one target to another.

Some interesting experiments were carried out this year in the endeavour to do away with the pause in fire which takes place between the time when a rapidly moving target gets to within about 800 yards of the battery and the time at which case shot fire commences. Hitherto Battery Commanders, remembering the time it takes to fix, set and clamp a time fuze, which operation may well be mismanaged if cavalry is rapidly approaching the guns, have been content to abandon

the fire of time shrapnel when the target is some 600 to 800 yards from the guns, to load with case and await the entrance of the enemy into the deadly case zone.

In Germany, this inconvenience is minimised in that the fuzes require no clamping, and, even if shell are taken straight from the limber, where they are carried fuzed, the fuzes are carried set so that the shell, without further adjustment than putting in the detonating thimble, will burst some 250 to 300 metres from the gun. Thus, at a most critical moment, the *personnel* of the battery is relieved from all but the most mechanical functions of the service of the piece, and the zone immediately beyond that of effective case shot fire is covered by an extremely rapid fire of time shrapnel.

In order to bring the service of our batteries near to this level, it was ordained at Okehampton this year that, whenever a battery found itself in such a position where it might be taken in flank (*i.e.*, unavoidably at practice, when the running targets were known to be ready) one portable magazine of shrapnel, with the fuzes set and clamped at $1\frac{1}{2}$ to $1\frac{3}{4}$, was to be placed by each gun. When used at ranges from 800 to 400 yards, the fire was very rapid, in one case 13 rounds a minute, and the deep reaching cone of dispersion at short ranges amply compensated for the shortness of some of the bursts, which were from 200 to 300 yards from the guns, when the target was some 700 yards off. The cavalry officers who saw the practice were particularly pleased with the *feu-d'enfer* which their representatives braved, and in some cases successfully rode through.

In referring you to the table of the results of battery service practice for the year, it is almost impossible to avoid making some comparison between the shooting of the batteries, but I would warn you not to do so without very carefully taking into consideration all the varying conditions under which the different batteries practised. For instance, to take a single case, the average size of the targets practised at by the batteries at the beginning of the season was about 56 dummies, while towards the end of the season it dwindled down in some cases to 26; therefore a battery destroying one dummy in the larger target would only destroy two per cent. of its target, while a battery destroying one dummy in the smaller target would destroy four per cent. of its target; but the first battery has the chance of destroying more as its target is larger. This is only one of the minor difficulties of estimation, but, from the data before you, it is possible for everybody to make up his mind for himself as to the shooting of the various batteries.

The above-mentioned difficulties do not apply in so great a degree when we consider the averages of the past three years, in which the target, range, etc., have been approximately the same, and I draw your attention to these.

The percentage of target destroyed per minute has greatly increased and this is owing to the smarter and quicker performance of the batteries as exemplified by the increased rate of fire.

It is, perhaps, natural that with this increased rapidity of fire we should lose at first some of the accuracy which was induced by the old

slow shooting-at-a-mark system, and this is shown to be the case by the gradually decreasing casualties and hits per shell, which go down at the same rate that the rate of fire goes up. So far, however, no harm has been done for we are arriving at the consummation of our wishes, the destruction of the target in the shortest possible time, more rapidly than heretofore, but with a proportionately greater expenditure of ammunition. We must take care, however, that we do not fall into the other extreme of hurried fire, which would tell upon the average by the loss of effect that always accompanies it.

As a direct incentive to care and thoroughness in drill and training, in which the reward so soon follows the effort, I refer you to the last line in the table which shows the effect produced by the 58th (Instructional) Battery. The ranges varied from 3550 to 600 yards, with an average of 1750, which is undoubtedly shorter than the average of the other batteries, for the reason that the targets shot at during these series were generally placed under the direction of infantry officers, who desired to see what losses their men would incur in the attack on artillery, from the time they extended up to the time they arrived within such a distance that they could use their own arms with effect.

(Taking the experience of last year's practice with this, the figures show that in the FRONTAL ATTACK OF UNSHAKEN ARTILLERY infantry would lose about 50 per cent. of the firing line between 2400 and 700 yards, and more if exposed to fire in closed bodies at long ranges.)

This battery, when it first came up, started under no more favourable conditions than any other, but about double the allowance of ammunition that any other battery had, and careful drilling on off days when there was no practice, produced the result before you.

Time.

A good deal of trouble has been taken this year to hasten the moment when the truly effective fire, that of shrapnel shell, begins, and the results of those efforts are given in a table.

In writing last year on this subject I ventured to say that a properly trained battery should be able to open shrapnel fire at any range up to 3200 yards in four minutes. This statement was received with incredulity by one of the service papers, and also looked at rather doubtfully in the pages of the "Proceedings" of this Institution, but I think that the figures before you sufficiently bear out my statement.

The average time from action to first round remains the same, but a striking difference is in the time that a battery takes to range itself. If we admit that in many cases artillery at the longer ranges does not disclose its position until it opens fire (and not always then with smokeless powder), then shrapnel fire commences on the average four minutes and eight seconds after the presence of the guns is made known. Be it also remembered that if the battery is properly ranged the first shrapnel, even if it burst on graze, is likely to be effective.

In order to hasten on as much as possible the opening of effective fire, the 58th Battery was told off to fire some series coming into action with loaded guns, after the fashion of foreign artilleries and

also of our own artillery in India. When this is done effective fire is opened on the average in three minutes and 17 seconds from first gun. This result should lead to the general adoption of this method.

Rates of Fire.

There is still great room for improvement in the rate of fire; very few of the batteries paid any attention to the keeping of regular intervals of time between the rounds when at ordinary or rapid fire, the consequence was that the fire was generally a sputtering discharge followed by a pause, more or less long according to the smartness of the battery; after a few rounds in this manner it was quite obvious that, in order to avoid this pause, the men were beginning to hurry, with the usual accompaniments, and there is scarcely a practice report of any battery which does not show that, after the word "Ordinary fire" was given, the laying of the battery fell off.

To insist on the intervals of time being kept to a second may seem pedantic, but there is a very good and sufficient reason for it, and it is better to risk being considered pedantic than to fall away into the other extreme.

It is stated by foreign gunners who have been under heavy fire that irregular fire such as that described, as well as the firing of salvos, tends to bring about bad practice and to render the men unsteady; because, when all the guns of the battery are empty at once, they feel that they are for the time defenceless and there is always hurry in order to get loaded again, and also that, unless kept very strictly in hand, fire tends to get quicker and quicker until it gets quite out of hand. What is striven after abroad is a regular rate of fire in which rounds shall be fired at stated intervals with the regularity of clockwork; this regularity of fire, by its very monotony, is stated to have a wonderfully steadying effect on the men's nerves, and the comparative calm thus produced is conducive to good practice; while by the irregular method of fire the men are worked up to the wildest pitch of excitement, with its consequent bad practice.

There is also another very good reason why hurried fire should never be allowed, and that is to avoid the too rapid consumption of ammunition. It must be remembered that there is only sufficient shrapnel actually with the battery to keep up an ordinary fire for from two hours to two hours and 40 minutes, which is just sufficient for the Divisional Reserves to arrive in; but if the fire is rapid there is only enough shrapnel for from 56 to 80 minutes, and thus the battery might completely exhaust its ammunition before there was the least chance of replenishing the limbers and waggons.

Besides slow fire, the only rate of fire, with one exception, that should be recognised in a battery firing under service conditions is rapid or ordinary fire from the right or left, and the guns should be fired in succession right through the battery, by this means only is the fire really kept under control and in the hands of the Battery Commander.

Ordinary or rapid fire by sections against a standing target should never be resorted to at service practice; it was allowed this year

because it was brought in to try and bring four-gun and six-gun batteries approximately under the same conditions for competitive practice, but the number of rounds delivered by a six-gun battery with ordinary fire by sections, if it is properly kept up with 20 seconds intervals, is exactly the same as if the battery fired rapid fire with seven seconds intervals right through from a flank, and by this latter method much greater regularity and less flurry would be ensured. Moreover, ordinary fire by sections could not be kept up long except under very favourable conditions by any battery; 40 seconds, which is the utmost time a gun would have, is not, as a rule, sufficient time in which to run up, load, and lay with precision for more than two or three rounds. In rapid fire from a flank, seven seconds intervals, each gun has also 40 seconds interval, but I do not think that this fire should ever be resorted to except with case shot, where no running up is required and the laying is only very rough.

The only time when rapid or ordinary fire by sections should be allowed is when firing at a moving object and the number of rounds is specified, thus "Rapid fire from the left of sections; One Round," because it is desired to catch the enemy at a particular spot; the reasons for not firing a salvo on this occasion are given by Prince Kraft.

The practice of Nos. 1 ordering their guns to be fired without any word of command from the sectional officer is not so prevalent as heretofore; one reason for this grave breach of fire discipline is very curious, and I will give it to you in detail.

In the older drill books it was laid down, and the wording has survived into the one at present in use, that, in ordinary fire, one gun is to be fired when the shell is home in the gun next to it. I have observed over and over again at drill and sometimes at practice, a No. 1, instead of attending to his own gun up to the last minute, watching the gun next to him and giving the word to his own gun to fire as soon as the shell went home in the next gun, without waiting for the sectional officer to give the order. I was very much puzzled for a long time to account for this practice, but I think I have arrived at the solution. In old days when the centre section was armed with howitzers and the indifferent powder was carried in flannel bags, there was a certain amount of danger that a spark from one gun might ignite the charge in one of the howitzers or even the cartridge being carried up to the next gun, so the order was issued that no gun was to be fired until the charge of the next gun was quite safe in the bore with the projectile on top of it. Surely, now that this danger does not exist, and we, moreover, put the projectile into the bore before the cartridge, this old world custom might be allowed to drop out of our drill-book. If rigidly adhered to the intervals between the rounds would depend upon the smartness of each detachment, and the time might be indefinitely prolonged if one of the loading numbers was killed at the moment of loading.

In order to ensure regularity of fire it is necessary to drill for some time watch in hand until the sectional officers have become accustomed

to the intervals that they should give according to the rate of fire ordered.

Competitive Practice.

There is no doubt that the chief interest of this year's practice was centred in the competitive practice and, considering that it is the first year in which it has been tried, the scheme has given satisfaction and is likely to conduce to the improved shooting of batteries. Being a first attempt to formulate a scheme a few small points requiring amendment have naturally come to light; I propose to touch briefly on these.

Many officers consider that the 50 per cent. allowance for four-gun batteries gives them an advantage over six-gun batteries. This is not so, for if the shooting of the batteries practising at Glenbeigh be studied it will be seen that the effect of a six-gun battery, as calculated by adding 50 per cent. to the effect of a four-gun battery, is practically identical with the effect actually obtained by a six-gun battery.

Four four-gun and four six-gun batteries practised, the shooting was remarkably even, and the average of the four has in each case been taken.

	Number of projectiles.		Target.	Casualties.	Credits.			Fire Discipline.	Total.
	C.	S.			I.	II.	III.		
Four-gun actual practice	25	68	90	67	102	39	46	49	—
50 per cent. ...	—	34	45	33	51	19	23	—	—
Six-gun by calculation	25	102	135	100	153	58	69	49	329
Six-gun actual practice	23	104	135	111	141	63	88	45	338

It is not, of course, necessary to add 50 per cent. to the number of common shell for, in either case, the number of ranging rounds would be the same. If any advantage exists on either side it is in favour of the six-gun battery in No. III. series; but this can be met by making the column for the four gun battery occupy the same depth as that for the six-gun battery, *i.e.*, by putting the sections one-and-a-half paces apart instead of one pace.

In places such as Glenbeigh and Shoeburyness, where it is not possible to put the dummies of the first series into shelter-trenches, four points for every dummy disabled appears too high; for the number of points scored during that series was double the number scored in any other series. Whereas, when shelter-trenches were used, as at Okehampton, the scoring in each series is more nearly the same, and three points per dummy disabled appears to be the correct value.

It is also desirable in the opinion of most officers, that the marks

for fire discipline should be increased to about 100. Out of the 50 now allowed, almost any battery can obtain 30, and the remaining 20 marks at the disposal of the umpire are not sufficient to adequately discriminate between the various shades of excellence to which the batteries have been worked up.

Exception is sometimes taken to the modern system of fire discipline, and to the competitive practice as accentuating the objection, that it is such a thoroughly "one-man job," and that in order to secure success at the competition, Battery Commanders rely upon themselves and their six qualified layers, whom they exercise upon every possible occasion to the exclusion of others. This has certainly been observed in many cases this year, and the reserve gun-layers were, in most cases, greatly in want of practice. It has been suggested that this might be overcome by causing different gun-layers to be used during each series of the competition. This would at least ensure 18 carefully-trained layers per battery; for, if the result of the competition depended on them, Battery Commanders would see that they were properly and sufficiently trained.

The present competition has this great disadvantage, that a battery practising on any but the liberal "A" scale at Okehampton uses up the whole of its ammunition for the competition and often has not enough for that, to the total exclusion of elementary and brigade practice.

This will have to be met either by shortening the time during which the firing may go on or by limiting the number of rounds to be fired, and allowing extra marks to batteries firing the stated number of rounds in the shortest time.

The advantage of limiting the time and not the ammunition is that a very simple method of scoring is obtained, which can be thoroughly understood by all the competitors, whereas, with time allowances, there is almost always a loophole for an argument and they are not well understood by the men.

Summary of Competitive Practice, 1891.

OKEHAMPTON GROUP.

Battery.	Guns. Number.	Guns. Nature.	Ammunition Expended. Common.	Ammunition Expended. Shrapnel.	Credits. Series 1.	Credits. Series 2.	Credits. Series 3.	50 % Allowances.	Fire Discipline. Credits.	Total Points.	Prize qualified for	Remarks.
"D," R.H.A.	4	Pr. 12	18	67	56	26	8	45	43	178	—	Aldershot.
"I," "	6	12	26	77	120	56	82	—	56	314	2nd	Aldershot.
"K," "	6	12	26	79	8	34	20	—	51	113	—	Aldershot.
58th Field ...	6	12	20	107	36	66	88	—	60	250	3rd	Exeter.
6th " ...	6	12	21	76	68	64	52	—	58	242	—	Woolwich.
40th " ...	6	12	31	53	24	58	74	—	49	205	—	Woolwich.
45th " ...	6	12	20	98	64	66	24	—	46	200	—	Woolwich.
"G," R.H.A.	4	12	28	83	60	52	58	85	52	307	2nd	Dorchester.
3rd Field ...	6	12	24	95	128	76	90	—	48	342	1st	Trowbridge.
66th " ...	4	12	17	79	80	52	54	93	56	335	1st	Christchurch.
1st " ...	6	12	18	90	60	32	82	—	56	230	—	Sheffield.
11th " ...	6	12	22	81	36	40	34	—	45	155	—	Sheffield.
37th " ...	4	12	16	65	64	38	28	65	52	247	—	Exeter. This battery had not got Scott's telescopic sights.

SHOEBURYNESS GROUP.

32nd Field ...	6	12	20	50	112	8	48	—	55	223	—	Aldershot.
47th " ...	6	12	20	40	56	36	72	—	45	209	—	Aldershot.
4th " ...	4	12	20*	42†	80	44	18	71	25	238	—	Aldershot. *Percussion shrapnel. †One too late.
57th " ...	6	12	18	51	32	42	24	—	50	148	—	Aldershot.
67th " ...	6	12	24	83	104	62	80	—	60	306	2nd	Aldershot.
75th " ...	4	12	19	45	32	—	58	45	40	175	—	Aldershot.
30th " ...	6	12	28	65	132	52	68	—	55	307	2nd	Coventry.
33rd " ...	6	12	30	23	48	10	42	—	35	135	—	Weedon.
41st " ...	6	12	26	68	75‡	50	86	—	40	251	3rd	Weedon. ‡3 points added as 3 dummies were blown down at commencement.
25th " ...	6	12	24	56	100	36	24	—	45	205	—	Ipswich.
63rd " ...	4	12	20	43	72	26	4	51	35	188	—	Colchester.
18th " ...	4	12	24	24	100	32	2	67	53	254	3rd	Colchester.
77th " ...	4	13	19	51	4	12	0	8	50	74	—	Colchester.
73rd " ...	4	13	23	47	4	24	0	14	35	77	—	Ipswich.
"F," R.H.A.	6	12	23	52	16	50	80	—	55	201	—	Woolwich.
"J," "	6	12	23	61	56	18	2	—	50	126	—	Woolwich.
"L," "	6	12	26	77	52	68	6	—	58	184	—	Woolwich.

Summary of Competitive Practice, 1891.

GLENBEIGH GROUP.

Battery.	Guns. Number.	Guns. Nature.	Ammunition Expended. Common.	Ammunition Expended. Shrapnel.	Credits. Series 1.	Credits. Series 2.	Credits. Series 3.	50 % Allowances.	Fire Discipline. Credits.	Total Points.	Prize qualified for	Remarks.
74th Field ...	4	Pr. 12	29	72	96	20	48	82	55	301	2nd	Longford.
"E," R.H.A.	4	12	20	55	104	54	42	100	45	345	1st	Newbridge.
"O," "	4	12	26	66	92	46	52	95	45	330	1st	
64th Field ...	4	12	23	79	116	36	42	97	50	341	1st	Athlone.
49th " ...	6	12	24	113	152	86	90	—	45	373	1st	Fermoy.
69th " ...	6	12	18	89	120	28	90	—	45	283	3rd	Limerick.
80th " ...	6	12	25	129	168	62	86	—	50	366	1st	Athlone.
29th " ...	6	12	24	87	124	78	88	—	42	332	1st	Clonmel.
MORECOMBE BAY GROUP.												
62nd Field ...	4	12	24	40	92	30	60	91	58	331	1st	Newcastle.
16th " ...	6	12	21	56	128	86	42	—	57	313	2nd	
56th " ...	6	12	30	32	68	64	20	—	53	205	—	
12th " ...	4	12	32	42	48	44	26	59	58	235	—	Glasgow.
LYDD GROUP.												
7th Field ...	4	13	18	35	*—	—	8	4	25	37	—	*Did not come into action within 8 minutes.
14th " ...	4	13	23	39	Nil.	14	48	31	50	143	—	Shorncliffe.
52nd " ...	6	12	32	58	20	52	86	—	35	193	—	
HAY GROUP.												
10 Mountain ... Range :— 1500, 1800, 2000	4	2·5	16	93	68	50	60	89	54	321	2nd	Newport.

Time.—Average of Service Batteries—Okehampton.

Ranges.	No. of Series.	"Action" to 1st Gun.		1st Gun to 1st Shrapnel.		Total from Action.	
1890. Yards.		min.	sec.	min.	sec.	min.	sec.
1500—2000	43	1	9	5	19	6	28
2000—2500	23	1	20	5	53	7	13
2500—3000	28	1	18	5	14	6	32
3000—3500	9	1	16	5	51	7	7
3500—4000	3	—		9	14	—	
Average	106	1	14	5	35	6	49
1891.							
1500—2000	24	1	11	4	7	5	18
2000—2500	30	1	20	4	3	5	23
2500—3000	12	1	11	4	21	5	32
3000—3500	10	1	34	5	31	7	5
3500—4000	—	—		—		—	
4000—4500	5	1	58	7	16	9	14
Average	81	1	14	4	8	5	22
5 Series by 58th (Instructional) Battery coming into action with guns loaded. (In each case the range was accurately found).							
1891.							
1700	1	0	29	2	38	3	7
1800	1	0	43	3	11	3	54
2500	1	0	45	3	9	3	54
3000	1	0	35	3	10	3	45
3525	1	0	45	3	45	4	30
Average	1	0	39	3	17	3	46

Results of Battery Service Practice (including Competitive, but omitting those fired from behind Cover).

Battery.	No. of Series.	Average Range.	Rounds.		Target.		Casualties.		Hits.	Average Time.		Averages.			
			Common.	Shrapnel.	Dummies.	Guns.	Dummies.	Guns.		From Order to Action.	In Action.	Percentage of target destroyed per minute.	Cas'lties per shell.	Hits per shell.	Rate of fire. Rounds per minute.
		Yards.								min. sec.	min. sec.				
"D," R.H.A.	10	2250	74	182	538	6	189	—	366	4 2	13 58	2·5	·73	1·4	1·78
"I," "	10	2204	74	194	583	6	283	—	756	4 42	11 36	4·18	1·05	2·8	2·24
"K," "	10	2248	82	180	583	6	187	—	429	3 58	12 0	2·5	·713	1·6	2·07
6th Field ...	10	2269	66	177	479	6	196	1	366	3 50	10 9	4	·8	1·5	2·39
40th " ...	10	2305	97	122	479	6	139	—	533	3 9	10 56	2·6	·63	2·4	2
45th " ...	10	2296	66	211	479	6	178	—	311	3 29	10 56	3·36	·64	1·1	2·5
"G," R.H.A.	10	2163	85	164	262	2	147	1	697	4 4	10 48	5·1	·59	2·4	2·3
3rd Field ...	9	2637	64	189	329	—	174	—	656	3 29	13 2	4·8	·68	2·5	2·1
66th " ...	9	2623	55	145	284	—	133	—	390	2 52	12 10	3·8	·66	1·9	1·8
1st " ...	7	2353	36	156	263	—	127	—	254	4 11	13 41	3·5	·66	1·3	2
11th " ...	7	2361	42	160	263	—	98	—	217	3 51	11 29	3·23	·48	1	2·52
37th " ...	7	2339	42	149	218	—	107	—	264	3 35	13 37	3·63	·56	1·3	2
Aggregate ...	109	—	783	2029	4760	—	1958	—	5239	—	—	—	—	—	—
Average Series, 1891		2331	7·18	18·61	43·67	—	18	—	48	3 41	11 57	3·43	·697	1·5	2·15
" " 1890		2325	7·81	13·1	49	—	17·7	—	43·7	7 12	12 11	2·98	·806	2·08	1·7
" " 1889		2231	7·5	13	46	—	17	—	63·4	—	17 0	2·17	·831	3·1	1·2
Aver'ge of 22 series fired by 58th (inst.) Batt. '91		1750	6	16	40	—	25	—	60	—	4 40	13·17	1·34	2·72	4·4

OKEHAMPTON, *September 12th, 1891.*

W. L. WHITE, Captain R.A., Instructor School of Gunnery.

DISCUSSION.

LIEUT.-COLONEL SPRAGGE said as Lieut.-Colonel Commanding a Division at Okehampton this season, I think I may make a few remarks on what Captain White has told us. As regards the distribution of fire, I am quite of opinion that it is a very weak point, and it is curious that it should be so. Why is it that what is so easy on paper is so difficult in practice? This very difficulty to make the Majors understand, and for them to make the layers understand your wishes in the matter—the object to be attacked and how it is to be attacked. Then, even with all the regulations for practice and similar rules, there is still a doubt as to which is the right and which is the left of the target. This is a point which should be made clear beyond the possibility of a doubt. (Hear, hear.) Then there is the inversion of the target caused by Scott's Sights—and whilst on the subject of Scott's Sights I may remark that there is, I fear, a tendency to use them too frequently and on improper occasions.—It will hardly be credited, but I once saw them used for firing case shot. (Laughter.) The battery signallers were not at all what they should be, and I fear that we shall never get them satisfactory until they are paid. They are of the utmost importance with large bodies of Artillery. Capt. White has emphasised his remarks on exposure in taking up positions, but in connection with this he has omitted to note one very important point. That is, that as the layers are mostly Nos. 1 of sub-divisions it happens, not infrequently, that when the Major, Section Officers and layers are going forward to the position, the guns are left solely to the care of the Sergt.-Major What is to happen if one good shell is put in amongst the little group in front? or what is to guard against a panic amongst the men left thus without Officers or N.C.O's.? Be a Battery Sergt.-Major of the best, as he generally is, he cannot take the place of Major, Subalterns and Nos. 1; and even in the matter of bringing up a battery into position, I saw one battery thus deprived of its Nos. 1, arrive in position at close interval through the drivers in their excitement having closed in one team to another. I consider the system mentioned by Capt. White, and proposed for adoption, for covering the ground between the 800 yds. and case shot range at a rapidly moving object, worked excellently and was eminently practical, and I hope it may be embodied in the regulations. The arrangements for the supply of ammunition from the one line of wagons worked well, but I think batteries with a complete line of wagons should constantly practise them at field days instead of their being sent off the field as at present so often is the case, and wagons should be sent to Okehampton, to enable all batteries, whether 1st Army Corps or not, to practice with them. In the matter of fire discipline I saw a very great difference between batteries, certainly much greater than could be expressed by the marks given, and I quite agree that the marks for the competitive practice should be raised to 100 in this respect. I should be glad to see the competitive practice take place later in the camp, and to see it spread over several days. Why should it not, indeed all such service practice? At present there is a very large element of luck, due to weather and light. Eighteen gun layers in a battery is a very desirable consummation, but it would be almost an impossibility at such a station as this where the Majors have very great difficulties in training their men, and I fear that if insisted upon we should be liable to have eighteen indifferent instead of a less number of good layers. Before I conclude, I cannot help remarking that it is a very curious fact that three out of the four battery prize winners came from single battery stations, and would ask Capt. White whether his attention has been called to the fact—to me it points to the lesson that however admirable it may be to mass batteries together for manœuvres and practice, yet from an artilleryman's point of view the single

battery station has very great advantages during the winter months, as the Major has a far better chance of getting at his men than he can have at the larger stations. (Hear, hear.)

Major Dudley Buckle hoped that Officers of all ranks in every battery might be given more opportunities of practising the command of a battery in action.

Captain Apsley Smith, Brigade Major Aldershot, said the lecturer's statement as to the losses of infantry in a frontal attack on artillery requires, I think, to be sifted. Surely such a deduction from the hits on defenceless and stationary dummies is of little practical value. The Germans, speaking from experience, tell us that 25 per cent. of loss will stop the best troops; is infantry, then, never to make a frontal attack on guns? As a matter of fact, the percentage of loss from artillery fire has always been small. The lecturer advocates silent drill. I forsee a "boom" in silent drill. The paramount importance of strict discipline and of quiet within the battery is obvious, but ought we to lose sight of the value of the voice? Should not a commander be sufficiently near his men to control them by his orders and influence them by his bearing? Is not a system of signs and signals liable to break down in the heat of action? There are no less than 27 signals in the drill-book and in the latest instructions for practice. Before we pin our faith to so many refinements, let us be sure that they can be worked in battle. The lecturer attaches great value to "preparatory" positions, although I am glad to hear that he limits the probability of such positions being possible to the 1st artillery position. Given, that the advance into action is unseen, and that surprise is possible, I, for one, agree with him; but such conditions are surely exceptional, and can it be right to teach batteries always to expect them, and therefore to be unable to do without a "preparatory" position? On ordinary ground, batteries will have to advance in view of an enemy, and often under his fire; why then train them always to halt under perhaps imaginary cover, and then by gradually disclosing their exact position, to give an enemy every chance of crushing them? The difficulty of pointing out targets, and the necessity of so many instructions to battery commanders, to subalterns and to Nos. 1 would, I feel sure, be much less when the targets can move and shoot; and we should try to assimilate peace training to service conditions. I venture to think that batteries should prepare for action on leaving the line of march, and that the commanding officer, after galloping forward to select his general position, should return, give his orders, and lead his guns in line directly into action. After the first position, when the difficulties are greater, and the importance of training is enhanced, this is what must be done; I submit, therefore, that this is what batteries should, as a rule, be taught to do, leaving the step-by-step occupation of a position from a "preparatory" position just in rear to be practised only in special cases.

Lieut.-Colonel G. H. Marshall, R.H.A.:—I would ask Captain White about his views on the subject of "Distribution of Fire." Does he propose to discard concentration of fire? I believe the concentrated fire of massed artillery is enormously effective. For instance, at Wörth the Germans had a mass of 84 guns: they concentrated the fire of these on each French battery, and silenced each in turn. No doubt distribution of fire is necessary in certain cases, but I cannot think we are justified in discarding concentration. With regard to trying to get the first time fuze *right* instead of trying to get a *graze*, I submit that in view of the great difficulty of judging the burst of shrapnel, the latter method is best as giving a certainty of verifying. I quite agree with Colonel Spragge that it is unwise to collect in a close group the officers and layers of a battery in order to point out the target. The danger is much increased in a brigade division, where the commanding officer would have a group of three battery commanders, nine section commanders and 18 layers, a total of 30. The figures given by Captain White showing the improvement in the burning of the fuze

caused by lessening the muzzle velocity are most interesting. I hope that next year Captain White will be able to give us more information in this direction about the whole of the ammunition. I am sure I express the views of most Field Artillerymen when I say we are most anxious for the efficiency of our ammunition. It is no use to say we have the best field gun in Europe, the highest muzzle velocity in the world, and the most scientifically curiously constructed carriage, if at the same time our ammunition is not equal to or better than any that can be brought against us. I cannot agree with Captain White's statement that "the instructional battery started under no more favourable conditions than any other." Surely the fact of its starting under the same commander who had practised on the same ground the previous year was in itself a great advantage.

Major W. L. Davidson, R.H.A., asked the lecturer if he could suggest any reason for the apparent superiority in shooting of the batteries at Glenbeigh over those practising elsewhere, as it appears an extraordinary fact that six out of eight batteries practising there obtained 1st class, whereas only three out of 37 batteries did so elsewhere, he proceeded to say the lecturer suggested three possible alterations in the rules for competition, in order to equalise results. I consider that one course alone should be advocated at a meeting of Artillery Officers like the present, and that course is, that the amount of ammunition allowed on Scale D should be increased. 20 common, 58 shrapnel, 12 case and 30 empty common, whereas one battery at Glenbeigh was able to fire 25 common and 129 shrapnel in the competition alone. Colonel Spragge recommends that the competition should take place towards the end of the practice. I had the misfortune to practice on the Shoeburyness scale this year, and the competition not only came too early, but too late, and too much in the middle of the practice, and it was only by exchanging the recruits' rounds and case shot that we had enough shrapnel for it. Practical officers have been working for years more or less, by rule of thumb. The results have been collected and tabulated to great advantage. But I think there is a tendency to make the rules deduced from these results too hard and fast. I would therefore suggest that in the competition more scope be allowed the officer commanding a battery to commence shrapnel directly he judges he has the correct range without waiting to verify as he is now compelled by the rules, especially at short ranges such as 2000 yards.

Captain F. E. D. Acland said that since leaving the service he had had exceptional opportunities of seeing the development of artillery work in Europe, of witnessing experiments, and of learning the views of foreign gunners. It was lamentable to him to hear the lecturer congratulate the regiment on an advance when the percentage of hits of shrapnel fire was so ludicrously small. The mean error of the time fuzes was far too large—due without doubt to the high velocity—and he thought it would surprise the lecturer to hear that in Russia fuzes were rejected if the Imperial Arsenal could not pass a test which insisted on every fuze bursting at any range within a space 25 metres long. He criticised the new pattern of carriages and thought that however elaborate and complicated designers might make their breaks they could never get more work out of them than skidding the wheel which could be done more economically and with less weight by a few turns of rope on the nave as in the French field gun. He considered Major Clarke's paper on Shrapnel Fire in the "Proceedings" as a most valuable contribution, and he hoped that it would lead to the introduction of really efficient ammunition, so that we might have a chance of competing with foreign results. It amused him to hear the lecturer solemnly advise battery officers to judge of the accuracy of the setting their fuzes by comparing the observed results of such setting with the mean error of our most inaccurate and complicated fuze. The regiment was continually crying out for more ammunition, but so long as the present system of manufacture and introduction of stores continued, the expense would be too great. Take for instance our common shell, it was known

by him 6 or 7 years ago to be absolutely useless against even the smallest class of field work, was valueless against *personnel*, and yet the regiment was hampered with this expensive and inefficient projectile purely for ranging purposes, which seemed ridiculous. (Hear, hear.) Ring shells which were more or less efficient on graze against *personnel*, answered the purpose as ranging projectiles, and he believed were far cheaper than our steel common shell; they were universal abroad. All these difficulties with fuzes, projectiles and brakes would disappear so soon as we had the sense to have a gun with lower muzzle velocity. (Hear, hear, great applause.) He congratulated the regiment on the possession of instructional batteries, and hoped it was the beginning of a better system, as in Austria where he understand no experimental material was sealed still less introduced into the service without the recommendation and approval of practical gunners. He was no believer in the work of committees nor of draughtsmen until their labours had been purified by passing through the ordeal of the criticism of practical, though possibly less scientific artillerymen.

Captain W. L. White—The principal points that require answers are on the distribution of fire and the occupation of preparatory positions. Colonel Spragge has stated that the distribution of fire is a weak point, and arises from the difficulty of making Majors, and through them the gunlayers, understand what is required. Is not this the best possible argument in favour of a careful pointing out of the target before the batteries are committed to action? If the target is not carefully apportioned among them, Majors generally select the most conspicuous object to range upon (we had an example of it this year of several batteries ranging on the same conspicuous spot) irrespective of the tactical sequence of the fight. It is the same in every service; have we not the historical example of the church tower at Chulm to point the argument? With reference to what Colonel Marshall said about the huge group, it is not intended that all those persons should be collected together. The Lieut.-Colonel would first inform his Battery Commanders and they afterwards would communicate to their gunlayers.

Colonel Marshall—Then that would take more than 3 minutes and 41 seconds.

Captain White—Yes, perhaps double that, or even 10 or 15 minutes: but what is that as compared with the importance of entering upon a life and death contest, that will probably last some hours, with everyone fully aware of the task before him. Are not the difficulties of pointing out now much increased by the use of smokeless powder which gives no indication of the position of the target? Colonel Marshall mentions concentration of fire. In advocating the distribution of fire I do not in the least wish to discard concentration, but it must be concentration against a tactical point and not against a so-to-speak mathematical point, such as a single gun. The tremendous effect of modern shrapnel does not require the concentration of fire against single points to the neglect of others, indeed it would be dangerous to do so because the remaining guns would then practice almost under peace conditions and with almost peace precision. But the concentration of superior force and fire against a tactical point is highly desirable. The concentration of fire for a short time at Wörth was unpremeditated. The 84 guns of the Vth Corps silenced the French guns opposed to them in the ordinary way by a fire distributed over their whole front, with the exception of one battery on the French left, which was so posted that it was difficult to get at, this battery then, being at one time the only one left in action, did, I believe, for a short time attract a concentrated fire. With reference to Captain Smith's opening remark, the loss I mentioned was 50 % of the *firing line* only, which is less than 25 % of the 1st line. Will he not too allow that the use of shrapnel shell is likely to produce more losses than when common shell was the only

projectile? With regard to the silent drill mentioned by Captain Smith. It is generally regarded as a great success (there are only 15 signals and not 27 as stated by him, for those in the instructions include those in the Drill Book). The value of the voice is no doubt very great and, by silent drill, it is hoped to preserve it unimpaired. At the end of a long day's fight if the voice were exclusively used there would be little of it left, and it is incontestible that when at silent drill the Battery Commanders voice *is* heard it attracts immediate and fixed attention. Major Davidson's remark about the shooting of the batteries at Glenbeigh is answered by Colonel Spragge's remark that he notices that three out of the four prize winners at Okehampton came from single battery stations. All the batteries at Glenbeigh came from one or two-battery stations.* With

*The following is an analysis of the practice from the point put forward by Colonel Spragge:—

Station from which the batteries came.	Total number of batteries shooting.	Prize qualified for.			Not qualified for a prize.
		I.	II.	III.	
1 battery	10	4	4	1	1
2 battery	12	4	0	2	6
3 battery	9	1	1	1	6
More than 3	15	0	2	0	13

reference to Colonel Marshall's remark about the Instructional Battery, I had no desire whatever to disparage the shooting of other batteries, but merely to point out the great advance that is made when the supply of ammunition is great. With regard to Captain Acland's criticisms on the *matériel*, it was not my intention to notice this point at all, because we have got to do the best we can with what is given us, but, as he has drawn attention to it, I should like to say a few words. With regard to fuzes, I believe that in the time and percussion small we have one of the best fuzes in Europe. (Loud and prolonged laughter.) Certainly as a manufactured article, but it is unfairly handicapped by the high velocity of the gun. (Hear, hear.) Let me give you an example. When the German gun was tried some two or three years ago at Shoeburyness, the German fuze completely beat ours in the smallness of its mean error; but when shell were made for the 12-pr. which took the German fuze, then that fuze was a failure as compared with our own, which clearly demonstrates that the gun and not the fuze was at fault, and that the inaccuracies are due to the high velocity given to the shell. With regard to the common shell, it is acknowledged that the effect obtained against earthworks by a powder burster of any field gun common shell is, comparatively speaking, worthless, and the idea has been abandoned of using it for this purpose. It is desired then to increase the man-killing properties of this shell, which are at present contemptible (it breaks, or rather tears, into three or four pieces only), and to substitute for it a ring or segment shell, but here again the high velocity of the gun leads us to an *impasse*. A shell to be fired with high velocity must be tough, otherwise it will break up in the bore and be more dangerous to friend than foe. Now a tough ring-shell is an anomaly, and if the segment shell have a tough envelope it is liable to hold the fragments together when the bursting charge acts. Still, there is the present state of the question—our present common shell is condemned in principle and we want a new one. The whole question of high muzzle velocity, as it acts and reacts on the ammunition question, is a regular house-that-Jack-built. High muzzle velocity means a

tough steel shell, and that means, as far as we know at present, that the common shell is worthless as a man-killing projectile. Therefore our shrapnel shell must be used as a percussion projectile when we require one. Therefore the burster of the shrapnel must be in the head. The burster being in the head when the shell is used as a time shrapnel, the bullets are retarded just when they should be accelerated, and, therefore, in order to give them a killing velocity at a long range, we must give an excessive muzzle velocity so that we may attempt to make good the 130 f.s. that they lose when the shell bursts at the end of the range; and there we are back again at the starting point. High velocity induces disadvantages that apparently can only be combatted by high velocity, and that not satisfactorily. The solution then of the difficulties and disadvantages set forth by Captain Acland appears to lie in the simple reduction of the muzzle velocity, say to some 1550 f.s.; this would enable us to have a man-killing common shell and a shrapnel with a bursting charge in the base and would give our fuzes fair play; also, and not least, it would so reduce the strains that a reduction in weight of the system and simplification of structure would be possible, and thus meet some of the severe strictures that have been passed upon our latest carriage.

The discussion then closed with a vote of thanks to the Lecturer, proposed by the CHAIRMAN, and carried unanimously.

A RETROSPECT

OF THE

EQUIPMENT, SERVICES, &C., OF THE 1ST AND 2ND RUSSIAN MOUNTAIN BATTERIES IN THE LAST WAR.

BY

MAJOR H. C. C. D. SIMPSON, R.A.

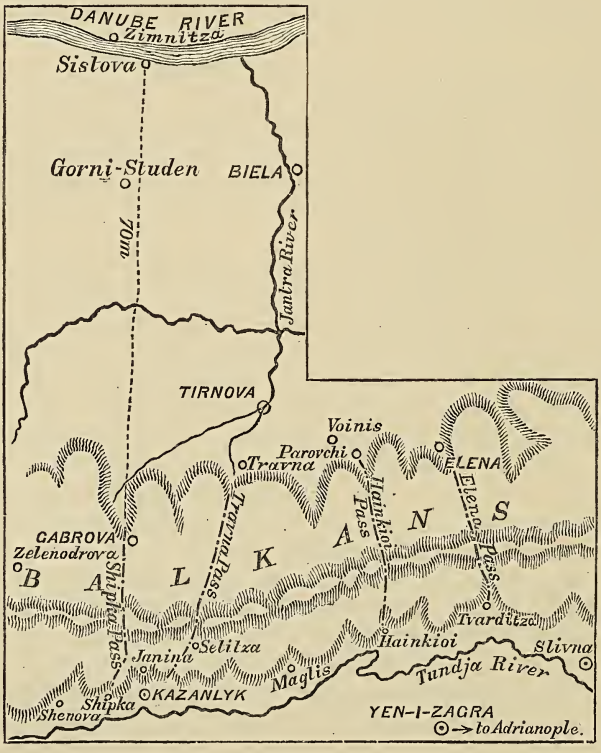
The part played by the Russian Field Artillery in the War of 1877–8 has everywhere received so much hostile criticism that the excellent services performed by the small force of Russian Mountain Artillery engaged have been passed over in silence by the majority of military writers of the war. Although, owing to a printer's error in a paper written three years ago for these "Proceedings," by the omission of the words "except perhaps in Bulgaria," I was reported as stating as my belief that Mountain Artillery was never likely to be required for service in Europe, such is not the case. No military writer would presume to state that the Balkans is an unlikely theatre of war for us in the future, so I venture to hope that the subject of this paper may not be an uninteresting one to officers whether of Mountain Artillery or otherwise.

Prior to the mobilisation of the six Russian Army Corps in the autumn of 1876, there were but four Mountain Batteries on the estabment, belonging to the Caucasian Army Corps destined to operate in Armenia. In December, 1876, however, two batteries (the 1st and 2nd) were formed at Kischinev for service with the Army of the South, and 10 additional batteries were afterwards ordered to be raised for the operations of the coming spring.

Turkey was able to place 20 Mountain Batteries in the field according to report. The fighting establishment of a Russian Mountain Battery at this time is laid down as:—1 Lieut.-Colonel, 1 Captain, 4 Lieutenants and 2nd Lieutenants, 1 Sergt.-Major, 27 N.-C.O.'s, 145 gunners, 80 drivers, 4 trumpeters, 30 laboratory men, 8 riding and 120 pack horses, 8 guns, and 112 ammunition boxes each containing 7 rounds. The gun was the 3-pr. R.B.L., 1867 pattern, firing a 12 oz. charge, M.V. 697 f.s. Weight of projectiles—common shell, 10 lbs., shrapnel, 8 lbs. One horse was required for the transport of each of the gun, carriage, and wheels, and seven horses per sub-division for the ammunition. The weight of the gun was 2 cwt., carriage 198 lbs., wheels, 120 lbs. The establishment of a Turkish battery was on a very much smaller scale, consisting of:—1 Captain, 2 Lieutenants and 2nd Lieutenants, 1 Sergt.-Major, 1 Qr.Mr.-Sergeant, 20 N.-C.O.'s, 36 gunners, and 1 ordnance artificer and 5 battery artificers, 18 ordnance and 48 ammunition drivers, 3 trumpeters, 5 saddle horses, 18 gun and 48 ammunition and 6 store mules, 6 guns and 96 ammunition boxes. The guns were of two patterns, the Whitworth 3-pr. and Krupp's $5\frac{1}{2}^{cm}$ B.L. gun of 2 cwt.

In both countries the guns were put in draught wherever possible, to obviate the employment of a relief line of mules. By Russia, the two horses of the carriage and wheels were harnessed into a shaft attachment to the trail, tandem fashion; and by Turkey, one mule was harnessed into a shaft attachment somewhat similar to that of the Russian Mountain Artillery. In India it is necessary to maintain a relief line of pack mules, and any arrangement for draught is unnecessary; but it has been found advisable to adopt a form of draught for use as a relief to top-loaded mules on the line of march on a level road and for short movements in action, for our Imperial batteries. Much consideration has been given lately by France to the subject, and she has finally adopted such a system for her batteries "*de circonstances*" for service in the Alps or other mountainous districts in France, and for her Mountain Batteries in Algeria and Tonkin, of course dispensing with a relief line of mules altogether. The Turkish mules, especially those of the Armenian Batteries were of a very fine stamp. The latter batteries performed excellent service, notably in the successful repulse of the Russians at the attack on the Zewin Plateau in Armenia; but the services of the Turkish Mountain Batteries in Europe, even in the Shipka, were feeble in the extreme, and call for no comment.

SKETCH MAP OF OPERATIONS.



Scale, $\frac{1}{1350,000}$.

The 1st and 2nd Russian Mountain Batteries were manned by the Foot Artillery, and formed part of the advanced guard, under Skobeleff, of the left wing of the army formed for operations in Bulgaria. They crossed the Roumanian frontier, 50 miles south-west of Kischinev, on the 24th April, 1877, and came down subsequently to the Danube at Beia, a point about equi-distant from Nikopolis, Sistova, and Rustchuk. On the 26th June, orders were issued for the advanced force to cross the Danube at Zimnitza-Sistova, under Dragomiroff.

The troops directed to make the crossing comprised a Division of the VIII. Corps, a Regiment of Rifles, and the two Mountain Batteries, with some Cossacks.

The Danube at the Zimnitza-Sistova crossing is about 850 yards wide, with a rapid current. The approaches to the banks on the Zimnitza side are marshy, and commanded by the steep slopes of the opposite shore. For making the passage the troops were divided into six detachments, with a Mountain Battery attached to each of the first two, the post of honour being given to Lieut.-Colonel Strebiltsky's or 2nd Mountain Battery. Shortly after midnight, the first batch of pontoons were ferried down into the main stream below Zimnitza, and the crossing commenced. Five Field Batteries had been posted on the banks to open fire on any troops that might open fire on the flotilla. When within about 50 yards of the southern bank the first batch of pontoons was discovered by the Turkish outposts, who opened fire on them, and as the second batch arrived in main stream, a Turkish shell struck a pontoon carrying the leading section of the 2nd Mountain Battery which sank, and the whole of its contents, comprising Lieut.-Colonel Strebiltsky, two other battery officers, 19 gunners, and the two guns and equipment were lost. The remaining portion of the battery, however, accomplished the passage successfully, and, disembarking under a heavy fire, climbed the steep bluff and advanced on Sistova, which is situated on a plateau rising almost perpendicularly from the banks of the river. The guns were brought into action, and opened fire on the Turkish position at about 500 yards range. By 11 a.m. the 1st Mountain Battery was also across and in action with the 2nd, and the enemy were eventually compelled to retire, and Sistova occupied by the 4th Rifle Brigade. A French military writer, describing this early incident of the war, states: "It is a fact worthy of note, as it has rarely happened in making a hostile passage of a river, that artillery should accompany the leading detachments of the force, unless a bridge has been built capable of supporting it. In this instance two Mountain Batteries not only embarked and disembarked in open pontoons, but as soon as landed, came into action at short ranges on the enemy's infantry. This manner of utilising Mountain Artillery is of interest as proving that often, even in a country not mountainous, this arm which has been rather neglected (in France) may be usefully employed. Indeed, light guns capable of being readily taken to pieces and carried on pack animals or in sleighs, brought into action rapidly, and dragged short distances by hand, possess the elements of an artillery for which a *rôle* might frequently be assigned."

The two batteries eventually marched on to Tirnova, where they were concentrated with the force about to make the remarkable march with Gourko through the Elena Balkans. This force in question constituted the advanced guard of that portion of the Russian Army which had Adrianople as its objective. It was composed of 10½ battalions of infantry, 31½ squadrons of cavalry, three Horse and the two Mountain Batteries (less the section lost in crossing the Danube). Gourko's orders were to reconnoitre the surrounding country, gain possession of a pass in the Balkans by which the army could cross, and send his cavalry on when the force had arrived in the valley on the far side to cut the railroad and telegraphs leading to Adrianople. Having ascertained that there were no Turkish troops in any of the passes except the main one at Shipka, where there were about 3000 infantry, some bands of Bashi-Bazouks, and a Mountain Battery, Gourko drew up the following plan, which was approved by the Grand Duke Nicholas. To cross the Balkans with the whole of his detachment, with the exception of six squadrons of Cossacks and two Horse Artillery guns, by the Hainkioi Pass, one of the defiles through the Balkans about mid-way between the Travna and Elena Passes, first sending on his pioneers to make the trail practicable for his Horse Artillery. Two squadrons and two Horse Artillery guns were to proceed to Gabrova to watch the northern outlet of the Shipka Pass, and a small detachment of Cossacks was to proceed to reconnoitre the Elena Pass at the moment of starting, to make sure there were no Turks there. Only pack transport was to accompany the force. On issuing from the Pass, Gourko would turn to his right and proceed to Kazanlyk to the southern mouth of the Shipka, and, in conjunction with the detachment of the north, considerably augmented by a division under Prince Mirsky, attack it on the 17th July in front and rear.

The pioneers moved forward on the 10th July to clear the road, and on the night of the 12th the whole detachment moved forward from Tirnova (18 miles), and bivouacked at Voinis. On the morning of the 13th the force moved on 15 miles to the northern mouth of the Pass at Parovtchi, where Gourko halted from 1 p.m. to 5 p.m. to rest his troops.

The Hainkioi Pass, as it is called, is a mere mountain path, leading from Kelifar to Hainkioi along the Kelifar defile. The ascent of the mountain begins at the village of Parovtchi, elevation about 1800 feet. In the next 18 miles the road ascends 1900 feet, crossing the summit at an elevation of 3700 feet. The road descends in 12 miles on the southern slope, 2300 feet, the elevation of Hainkioi being about 1400 feet. The whole length of the defile, which passes through the wildest part of the range, is 24 miles, and the path narrow and tortuous, with precipitous rocks on both sides, impracticable for field guns owing to the narrowness of the track rather than to the slope of the gradients.

During the evening of the 13th, Gourko crossed the summit of the Pass, and bivouacked on the southern slope of the range at a point about nine miles from the village of Hainkioi. The portion of the detachment that arrived with him consisted of the greater part of the infantry, four squadrons of cavalry, and the two Mountain Batteries.

The remainder were either entangled in rear, or assisting in the transport of the Horse Artillery, which was experiencing enormous difficulties in their march from Parovtchi. The ordinary gun teams were supplemented by yokes of oxen and strong detachments of men, whilst the pioneers under Rauch, who had two days previously made strenuous endeavours to make the road passable for guns in draught, redoubled their energies to improve the path. Two guns with their teams fell down the precipice, but were recovered in the most creditable manner and hauled up on to the track. The batteries were, however, unable to debouch into the Valley of the Tundja on the southern side of the range for a day and a half later than the force previously mentioned, and to whose movements we now return. At 2 a.m. on the 14th the Mountain Batteries, with the infantry and four squadrons, continued their march, and at about 10 a.m. the little Turkish garrison of Hainkioi, consisting of 800 Regulars and some Tcherkesses, were completely surprised, and the little village at the mouth of the Pass captured. The enemy retreated to the left, to the village of Tvarditza at the mouth of the Elena Pass, where, uniting with the garrison of that place, they returned in the afternoon to the attack, but were routed by the force pursuing them, consisting of three battalions of Rifles, four squadrons, and the two Mountain Batteries, which followed them towards Slivno till nightfall, when, with the exception of one-and-a-half battalions and two guns told off to hold a position covering the main body from surprise from a possible attack from Slivno, the force returned to the main body at Hainkioi for the night.

On the 15th Gourko remained at Hainkioi awaiting the arrival of his Horse Artillery from the defile. It marched in in the evening, and on the following morning, after leaving four battalions, six squadrons, and the Mountain Batteries at Hainkioi to hold the Pass and position, the remainder started for Kazanlyk, a distance of 20 miles. Engaged half-way, Gourko was unable to occupy this place the same night, and on the following morning, after its capture, his infantry was so fatigued that he was unable to push on the additional eight miles to the mouth of the Shipka the same day.

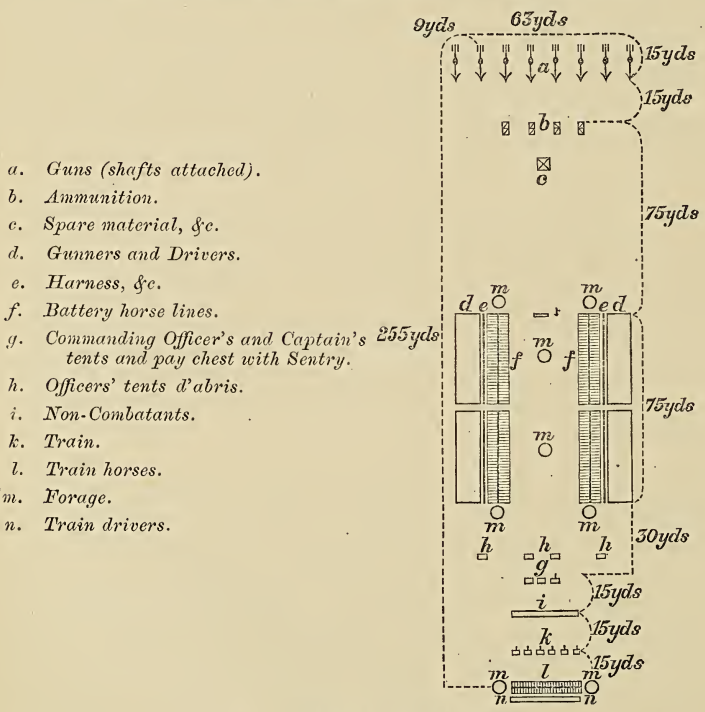
The attack was, however, made from the north, but utterly failed. Gourko determined to attack on the following morning, the 18th, the Turkish position on the Hill of Mount St. Nicholas, sending word to Mirsky he was so doing. The Shipka is not strictly speaking a Pass, as there is no gorge or defile, but a road which passes through a section of the Khodja-Balkans at less elevation than the remainder of the range. Although practicable for baggage on wheels, it is used habitually by pack animals or rough country carts. The road from Gabrova on the northern side of the range to Shipka village on the southern side is 16 miles in length. The elevation of Gabrova is about 1600 feet; the main Pass is 4600 feet; while the village of Shipka is about 1800 feet. The ascent takes usually four-and-a-half hours, and the descent one-and-a-half hours. The southern slope is the steepest, 40°, whilst the zigzag descent to Shipka is not less than 20°. The most elevated peak, Mount St. Nicholas, is 4800 feet eleva-

tion, and rises almost perpendicularly above the village of Shipka. The hills and ravines on both sides of it are practicable for infantry and Mountain Artillery, but only in parts for field guns.

Gourko unfortunately had left his Mountain guns at Hainkioi, so had to make his attack with infantry alone, it being impossible to utilise the Horse Artillery from the impracticability of the approaches to the Turkish position. After brilliant efforts on the part of the Russian infantry, the attack failed with great loss, but luckily on the night of the 18th the Turks, having no provisions with them, retired, and the Shipka was left in the hands of the Russians, to remain in their possession till the conclusion of the war. The Mountain Batteries were now concentrated at Kazanlyk, a half battery taking part in some further operations in the Tundja Valley against Suleiman Pasha.

Gourko had, however, to withdraw from the little Balkans, and the 1st Mountain Battery was posted in the Hainkioi Pass, and the six guns of the 2nd Battery in the Shipka, in the beginning of August.

MOUNTAIN BATTERY BIVOUAC IN GOURKO'S MARCH.



Scale, 75 yards=1 inch.

This expedition of Gourko's with an advanced guard of all arms was considered one of the most brilliant episodes of the war. It would seem to have been a mistake that the Horse Artillery was not sent through the Travna Pass, a defile between the Hainkioi Pass and the Shipka, and practicable for Horse Artillery excepting in the winter

months. By bringing the Horse Artillery guns through the Hainkioi Pass, a delay ensued which prevented the co-operation of Gourko's with the northern force, in the attack on the 17th. Moreover, the work towards Slivno on debouching from the Hainkioi defile, which should have been undertaken by the Horse Artillery guns, had to be carried out by the mountain guns, and to rest them they were left at Hainkioi, a total mistake, as their co-operation in the attack on the Turkish position on St. Nicholas was absolutely necessary. Yet their orders were not to advance till the 18th. We note also, as in the case of our own Indian Frontier Expeditions on several occasions, that Horse Artillery, and not Field, co-operated with the Mountain Artillery in these operations, which points to the advisability of our adopting a mountain gun, the projectiles for which shall be interchangeable with that for our Horse Artillery gun, as is the custom in France.

For the next five months the two Mountain Batteries assisted in the defence of the Passes against the numerous attacks made by the Turks, performing excellent service, notably the 2nd Battery in the determined assault of the Turks under Suleiman Pasha on the 23rd August, where its case shot fire saved the Russian position from being forced from the rear at a critical moment.

The fighting in the Shipka Pass itself has been already detailed in the "Proceedings," and is omitted, as for the same reason are the operations in the Armenian Plateau of the other batteries.

We now pass on to the crowning episode of the war, viz., the capture of the Turkish Army in the Shipka Pass and the advance of the Russian columns on Adrianople in January, 1878.

General Radetzky at this period commanded the force in the Shipka Pass, and his plan for forcing its passage was to divide his troops into three columns, one of which, under his own orders, was to remain in the works at the summit of the Pass, whilst the other two were to pass on either flank across the mountains, and attack the Pass from the rear simultaneously with an attack from the front by himself. The turning columns were constituted as follows :—The column of the right, under Skoboleff II., consisted of 22 battalions, six squadrons, the 2nd Mountain Battery, and six field guns on sleighs. It was to pass over the trail which leads from the village of Zelenodrevo to the top of the mountain, two-and-a-half miles from the top of the Bald Mountain, and descends thence to the village of Imetli in the Tundja Valley. Here the detachment was to turn to the left and attack the works defending the village of Shipka.

The column of the left, under Prince Mirsky, consisted of 26 battalions, six squadrons, the 1st Mountain Battery, and 16 field guns on sleighs. It was to leave the village of Travna and, passing through the Travna Pass, follow the trail over the Selky Hill, debouching into the Tundja Valley at the village of Gusevo, then turn to the right, and, joining hands with Skoboleff, act in concert with him in his attack on the Shipka Redoubt.

The movement was fixed to begin on the morning of the 5th, and it was calculated that the columns would arrive in the valley on the evening of the 7th, and attack the following morning. Mirsky's

column started accordingly with the Mountain Battery in the advanced guard on the 5th. It reached Selitza in the Pass at midnight the same day, having marched 20 miles through three feet of snow. Trouble soon began with the field guns which were with the main body, and, after a repetition of all the old difficulties experienced previously by Gourko exaggerated, Mirsky determined to leave them behind, and rely solely on his Mountain Artillery. On the 6th the advanced guard occupied the heights between Selitza and Gusevo. On the following morning the descent of the Balkans and attack upon Gusevo was easily effected, and the position captured after some slight resistance. A portion of the advanced guard occupied Maglis on the left flank at 8 o'clock in the evening, and was then ordered to hold itself in readiness to march on Kazanlyk the following morning, when Mirsky with the remainder would march on Janina. In the meantime the column of the right had been encountering great difficulties. The road which leads to Imetli descends into a steep ravine before passing through the defile of the Balkans, and the Turks, hastily occupying on the 7th a ridge north-east of the village of Imetli, took the line of march of Skoboleff's force in flank. The latter, arriving on the scene late in the afternoon, found the advanced guard lying down without returning the fire of the enemy, as the Turks had strongly occupied a position about 1500 yards off, across a ravine, against which the shells of the mountain guns with their low muzzle velocity were ineffective. Infantry armed with a better rifle were ordered up to the front, and compelled the Turks to withdraw during the night.

On the morning of the 8th hostilities were renewed, and Imetli occupied. Skoboleff, however, found himself unable to co-operate with the other columns as agreed, and was limited to making a demonstration with some infantry and the Mountain Battery upon an extended front. The first shell fell amongst some cavalry threatening his flank, and dispersed them.

This force remained in action the whole day, and at night fires were lit, bands played from the bivouacs on several points, and the mountain guns fired occasional salvoes, to give the idea to the enemy that a large force was present. The Field Artillery had, in spite of the 62nd Regiment which accompanied it, not yet arrived within one march of the force after 30 hours of incessant toil. The narrow, rocky path, covered with snow to several feet in many places, rendered their transport impossible, so they were left on the slope of the mountain in charge of a Bulgarian regiment, and Skoboleff determined to attack on the 9th with his mountain guns alone. These latter were now carried on camels, the pack horses having broken down. This, mules would never have done as long as the camels were efficient, and is one of the many proofs that inch for inch in heights, a pack horse is not to be compared to a pack mule for Mountain Artillery purposes in the opinion of our Mountain Artillery officers, though this is at variance with that of many Russians. To return to Mirsky, he had on the morning of the 8th moved forward with some infantry and the 1st Mountain Battery on Janina, which, after a short fight, he carried, together with the village of Hainkioi. Beyond this latter was a small

range of rifle pits, the hot fire from which brought the small force to a halt. The mountain guns advanced to within about 800 yards of the Turkish position and opened fire. A lucky shell exploded one of the Turkish limbers, and in the confusion that ensued the infantry rushed forward and carried the position. This brought the force in front of the last line of Turkish defences outside the Shipka village, which exhaustion and darkness prevented them carrying this night.

Skoboleff on the morning of the 9th advanced to attack Shenovo, a village a few miles south-west of Shipka. The guns of the 2nd Mountain Battery were placed in the centre of the line of advance, and Skoboleff placed himself in rear of them to direct the movements of his force. Arriving within long range of the enemy's position at Shenovo, the guns opened fire, which proved ineffective, but produced a certain amount of moral result. In order to give the necessary elevation to the guns, the carriages were buried and so the range increased, which, though diminishing the chances of inflicting loss on the enemy, deceived him as to the nature of the guns, which were mistaken for field instead of mountain pieces. After severe fighting, Shenovo was taken by the most brilliant assault in the whole war, deciding not only the day, but the whole fate of the Turkish Army of Shipka, which, attacked by both Radetzky on the front and Mirsky from the east, was completely defeated and broken up. On the 14th January the two Mountain Batteries were concentrated, and moved forward on Kazanlyk, with an infantry escort in support of the cavalry force advancing on Adrianople.

This brief account of the work done by the two batteries can but give a mere shadowy outline of their services, which now terminated.

Their system of tactics seems to have been vague in the extreme, doubtless due to the fact that up to this date the Russians had had but very slight Mountain Artillery experiences.

FIELD ARTILLERY FIRE.

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PREFACE.

THE following pages have no pretension to be a complete Fire Manual, but must be looked upon rather as a gloss upon the text of the Field Artillery Drill-Book, amplifying where some further explanation appears necessary and bringing the information contained therein up to date.

In none of the English text-books is there any extended information on the subject of Observation and Distribution of Fire; an omission which it has been sought, in these papers, to supply.

The Chapter on the Examination of Range Reports is quite new, and the method explained has already proved of great use at the Practice Camps of 1891.

It is hoped that this little work will prove of use to Officers in lecturing to their N.-C.O.'s and men.

CHAPTER I.

FIRE DISCIPLINE.

IN the days of smooth-bore weapons effective ranges were very short, and shooting was very inaccurate; with the musket of 1842 the percentage of hits on a target 6 feet high by 20 feet broad was—

at 100 yards	...	74·5
„ 200 „	...	42·5
„ 300 „	...	16
„ 400 „	...	4·5

Artillery was therefore used at what are, to us, very short ranges, from 400 to 600 yards, and even closer; guns were only sighted to 1000 or 1200 yards, and beyond 600 yards the effect of fire became very uncertain: at the range of 1000 paces only one-third of the shot hit the target then in use, which was 6 feet high and 50 paces broad. The method of procedure was for the Battery Commanders, using their batteries as tactical units, to bring their commands in as close as possible to the enemy and open fire, having first ordered a rough

approximation of the range to be given as elevation. In none of the old works on Artillery Fire do we find any mention of any subsequent proceeding for the purpose of rectifying the elevation, the reasons for which are very apparent:

(*a*) The smooth-bore might or might not respond to small alterations of elevation and such were really of not very great importance since, round shot being used, the projectile, if it fell short, would generally ricochet on to some part of the target.

(*b*) All subsequent corrections were made by the No. 1, for we find in all the older drill-books that "after giving the word 'Ready' No. 1 will step to that side of the piece from which he can best observe the effect of his round." Indeed, this observation was easy, for the eye could follow the projectile over its short trajectory.

Again, in the older drill-books, we do not find any stress laid upon the accurate pointing out of the target to the Sectional Officers and gun-layers, the reason for this is again obvious; at the short distance which separated the two opposing lines it was seldom possible that there could be much, if any, great choice of target to select from; it was like fighting in a crowd where it is only possible to hit out against the man immediately opposite. Thus, when a battery came into action, it is probable that the target and elevation were indicated only in the most sketchy manner such as "Artillery in front, 400 yards;" the selection of the particular portion to fire at, and all subsequent corrections of elevation fell to the Sectional Officers and Nos. 1. Indeed, most of us can remember the field-days, the survival of the old procedure, when a battery seldom had an objective pointed out to it, sometimes even no elevation was given and it was not unusual to hear the words "Blank cartridge, load! Fire one round from right to left and cease firing." The joy of getting off a round before one's neighbour being the reward for this, what is to-day, enigmatical proceeding.

With smooth-bores then, the battery was the tactical unit and the commander had to study and give his attention, to a great extent, to the tactical situation, while the gun, or at most the section, was the fighting unit.

Under the above conditions a system of fire-discipline, as we now understand the term, did not exist, nor was there any necessity for it, but the close proximity of the enemy, and the consequent greater excitement of the men, made a most rigid system of drill-discipline of paramount importance, in order that, in the turmoil of the fight, they might perform mechanically those functions which hours of laborious training on the drill-ground had taught them to carry out with the precision of a machine. In fact, what was required was "Discipline under fire."

After the introduction of rifled arms it was found that the old method of procedure was no longer possible. The greater range at which it is now necessary and possible to fight gives a very large choice of target to the batteries and makes a careful pointing out of the

objective necessary, and as it is no longer possible for gun-layers to observe the effect of their rounds and thus correct their elevation (which, owing to the improvements in projectiles, has become of great importance) this duty of the observation of fire and the rectification of the elevation becomes the duty of the Battery Commander. In order to give him time to attend to these increased duties it is necessary to relieve him of all, or almost all, tactical considerations, which now devolve upon the Officer Commanding the Brigade Division.

Thus, the Brigade Division has become the tactical unit and the Battery the fighting unit. That is, with the Officer Commanding the Brigade Division rests the responsibility for the manœuvring of, and the position taken up by the batteries, and the tactical application of their fire under such orders as he may receive from the Divisional General, while with the Battery Commander lies the responsibility for the technical administration of the fire of his battery.

It is only necessary to recapitulate these onerous tactical duties to show how much they must have occupied the Battery Commander of former days to the almost total exclusion of technical affairs.

The duties of the tactical commander, the Officer Commanding the Brigade Division, are now as follows:

1. To consider the tactical situation not only of his own troops but also that of the enemy.
2. To select and reconnoitre positions.
3. To point out the objective and divide it among the batteries under his command, changing it from time to time with the fluctuations and progress of the fight.
4. To control the rate of fire and thus nurse the expenditure of ammunition against the critical period of the battle, and to ensure the renewal of the supply, *i.e.*, beyond that in the immediate possession of the batteries.
5. To receive all orders from the commander of the troops and to keep him well informed.

Having been relieved from his tactical responsibilities the Battery Commander can now turn his full attention to the technical administration of his fire. It is a question of some moment to define precisely how far the Commander of a Brigade Division may interfere in the technical working of a battery, but, it may be taken as a general rule that if he does so, he does it at the imminent risk of losing sight of the important and absorbing *rôle* that falls to his share. There are, no doubt, occasions when the interference of the Brigade Division Commander is warranted, but, except on the practice ground, it is a matter which involves a great possible danger, and should therefore be strenuously avoided.

To enable a Battery Commander to fight his battery a sound system of FIRE-DISCIPLINE is necessary.

The British has been the last artillery of the European Powers to adopt a definite system of fire-discipline, and this arises, perhaps, from the fact that we have never, since the introduction of rifled guns, been

pitted against an enemy in the field who could take advantage of our lack of this quality. Against those with whom we have had to deal, the old "go in and win" system has been very efficacious owing to the prestige attaching to it, and possible on account of the indifference of the armament opposed to it.

Having, during the last few years, adopted a system based on those already in use by other Powers, we have avoided many of the errors inseparable from the inception and development of new methods, and our drill-book presents a more or less complete scheme to our notice. That this scheme is perfect it is impossible to affirm, and many officers give their constant care and attention to its improvement, but the very fact of our having stepped into a full-blown scheme has deprived us of the experience to be gained in working it out, and thus many of the improvements that have been suggested are based upon principles that have already been tried and found wanting by those gunners abroad who initiated the modern system and have brought it to its present state.

It is my intention, then, in the following pages, to deal generally with the principles upon which a system of fire-discipline should be based, to recount some of the attempts that have been made and the reasons for their failure, in order to place at the disposal of my brother officers materials for the perfection of our own system and to show them what exploded errors to avoid. The methods laid down in our own text-books deal only with results, and a study of them does not often reveal the principles upon which they are based, but this has been inseparable from the fact of our having taken advantage of the experience of others; at least, the principles could not have been enunciated without greatly exceeding the bulk of a "hand" book.

By FIRE-DISCIPLINE must be understood the possession by the battery as a whole, of a combination of those qualities which enable its commander, in the shortest possible time, to turn fire, of any desired nature and rate, upon any portion of the field at will.

That is, the battery must be so trained that its fire may respond smoothly and quickly as a machine, to the slightest touch of the guiding hand. To attain this pitch of perfection something more than mere mechanical excellence, such as that induced by a strict drill discipline, is required; and yet a strict drill discipline is the first step towards it, for by it men are taught to perform certain of their duties pseudo-mechanically, even under the greatest stress of excitement. It is necessary to be able to direct the mechanical process called "drill" in such a manner that the same causes shall produce varying effects at will. In short, to produce good practice it is necessary to be able *to command,* and that is the point upon which this most important subject of fire-discipline hinges.

To explain more fully. Unless we know how to command it will be impossible to take advantage of the state of mechanical perfection to which the battery may have been trained. The laying and the service of the pieces may be perfect, but we must be able to immediately indicate the target and ensure, by good observation, that the fire is properly applied. We must be able to change, with the utmost

rapidity, from one target, or from one nature or rate of fire to another. All this is understood by the word fire-discipline.

The Battery Commander being, so to speak, the motive power, it is of the first importance that all his orders should be conveyed intact to those portions of the machine that he wishes to set in motion. For this purpose the experience of many years has led foreign artillerists to formulate an axiom that : ALL ORDERS FROM THE BATTERY COMMANDER ARE TO BE REPEATED AND NOT INTERPRETED.

In the early days of the modern system of fire-discipline many schemes were propounded, some of which will be noticed in due course, that depended for their successful carrying out on the correct interpretation by the Sectional Officers of their Commanders' orders. Some of these schemes worked out in a satisfactory manner on paper and on the drill ground, some even partially survived the more searching ordeal of the ranges, but all have failed when tried by the standard of active service. Sooner or later one of the interpreters makes a mistake or is replaced by a less skilled one and then the whole scheme falls to pieces, whereas when all orders from the Battery Commander are carefully repeated the mental strain upon the *personnel* is greatly reduced and the working of the battery remains most completely in the hands of its commander.

The better to enable these orders, as given by the Battery Commander and repeated by the Sectional Officers, to be heard by all concerned, a system of silent drill has been introduced (*vide* "Instructions for Practice, 1891") which, by the supression of unnecessary noise, has had the effect of greatly improving the service of the guns and the rapidity with which orders are grasped and carried out; the reason for this being that all recipients have to be much more on the alert to catch a signal than they had formerly to be when they might trust to having their faculties stimulated by the voice of the commander. Should it ever be necessary to send an order, this applies especially to brigade practice, the best protection from mistakes is to send it in writing, but, as this is not always possible on service, it should be resorted to as seldom as possible and the message be sent verbally; it should be made a rule that every orderly, as well as every recipient of an order, should be educated to repeat the message "verbatim," thus only can mistakes be avoided. This habit of repeating messages is a matter of education, and cannot be acquired on the spur of the moment. The correct delivery of messages can be best ensured if officers make it a rule only to send short messages, omitting all that is self evident or best left to the discretion of the recipient.

It is perhaps needless to say that no system can succeed if orders, however correctly given and conveyed, are not punctually obeyed, and it was this point which produced some little friction when modern systems were first introduced into our service. It was hard to induce the old generation of gun-layers to give up what they considered their vested right, which was fostered by the late system of competitive practice, to observe the effect of the shooting and to modify sights and laying according to their own observation rather than submit unre-

servedly to the orders of the Battery Commander. It is impossible at service practice for the laying of each gun to be verified at every round by an officer on account of the delay that would ensue, and some of the range reports of not so very long ago show that gun-layers are in the habit, unless very carefully trained, of altering the sights or laying in accordance with their own judgment. The following is a case in point which occurred as lately as 1890. The battery was being ranged from one gun (which is wrong in itself).

Round.	Elevation.	Result. As judged by C.O.	Result. As judged by Range Party.
1.	2500	—	Target.
2.	2700	—	Target.
3.	2800	+	Target.
4.	2750	+	Target.
5.	2725	—	Target.

Here the Battery Commander, following his own observation, which was bad, proceeded perfectly correctly with the ranging process, but it is perfectly obvious, also, that the gun-layer did not put up the elevation ordered, otherwise he could not have succeeded in hitting the target five times running with elevations differing as much as by 300 yards. It is most probable that what happened was, that the gun-layer, who was perhaps brought up under the old *regime*, saw the effect of his first shot, and receiving orders to alter his elevation did not obey them, or, if he did, he must have layed off the target, which is an offence equally heinous.

It is quite clear then, from this example, that it must be particularly impressed upon gun-layers that they have nothing further to do with any projectiles which have left their guns, and must implicitly obey all orders they may receive and lay in the manner in which they have been taught. In a later chapter, on the examination of range reports, it will be demonstrated that a perfect check may be kept on the gun-layers without delaying the practice of the battery by verifying the laying of each gun before firing.

In the new competitive practice (1891) the moving of the gun-layers a few paces to a flank to observe the effect of their rounds has been a fruitful source of loss of marks for fire-discipline. Not that, in itself, there is any objection to these men knowing the result, but the practice is sure, sooner or later, to lead to their altering the elevation or laying to suit their own observation and thus practically taking the direction of fire out of the hands of the Battery Commander.

In the selection of gun-layers great care should be taken that they all lay not only accurately but uniformly, and all in the regulation manner, that is to say with a full sight, in order that the Battery Commander may not have to complicate the mental process which he has to go through, by having to make allowances for the varying performances of the pieces arising from the personal peculiarities of the several layers.

In the selection of layers something more than good eye-sight must be sought for, namely intelligence sufficient to at once pick out a

target verbally indicated on occasions when a detailed pointing out is impossible, and also ability to set sights correctly. It is by no means uncommon to find sights wrongly set, and it is manifest that, however good the laying may be, it is useless if the proper elevation has not been given. Indeed, in using telescopic sights, where the personal error is eliminated, intelligence rather than good eye-sight is required. The instructions for selection of layers, as laid down in the pamphlet on the competition for skill-at-arms, give plenty of scope for the elimination of unintelligent layers by allowing no marks for rounds in which the sight has been wrongly set or the gun laid on the wrong objective. Abroad, where the *chef de pièce* or gun captain is other than the *pointeur* or gun-layer, the verification of the setting rests with him, and it is again, in many cases, inspected by the Sectional Commander, a process which must involve unnecessary delay if intelligent gun-layers are selected in the first instance.

CHAPTER II.

Bringing Batteries into Action.

The battery being in an efficient state as to its drill, and the gun-layers carefully trained to carry out correctly orders given to them, the first step towards a good fire effect will be to bring the battery into such a position that it may be able to administer its fire advantageously, and to point out to the gun-layers what is required of them.

Let us assume that the battery with which we have to deal is one of a brigade division of three batteries, forming part of an independent division, which is on the line of march. The proper place for the Lieut.-Colonel commanding the brigade division is with the Divisional General, who will generally ride at the head of the main body of the division. On news being received from the front that the advanced-guard has been checked, or has come across the enemy in position, the General, with his Artillery Commander, will ride forward to reconnoitre the enemy and determine what steps are to be taken to oust him from his position. During this stage of the proceedings all the instructions that the Lieut.-Colonel is likely to receive are given to him in the shape of a tactical sketch, the details of which, as regards his special arm, are left to him to fill in, in accordance with the general plan of operations. To enable him to do this correctly he must be a careful and constant student of the tactics of the arms to whom he is auxiliary, for by this only can be avoided the perpetual sending of orders, which tend to fetter the genius of subordinate commanders and render the combat slow and wearisome.

Having been made acquainted with the wishes of the General, the Lieut.-Colonel will select a position for his batteries from which they can best forward the object that the principal arm, the infantry, has in view. To do this without attracting the attention of the enemy he should dismount before actually approaching the firing position, and all orderlies, etc., should be left out of sight in rear. He will also select a preparatory position, as close as possible to the firing position

and hidden from the view of the enemy. The selection of a position for the second line of wagons is treated of under the heading of "Ammunition Supply."

In the later stages of the fight it will seldom be possible to select a preparatory position, nor would time permit of its being occupied, and the batteries will have to advance straight into the firing position selected and reconnoitred for them by the Lieut.-Colonel, but, at the long ranges at which the earlier stages of the fight take place, the lie of the ground will generally offer suitable preparatory positions within easy reach of the firing position.

The Lieut.-Colonel then sends off his Adjutant to guide the batteries into the preparatory position, himself remaining on the firing position in observation of the enemy. When the batteries have arrived in the preparatory position he calls up the battery commanders, who dismount before reaching him and keep as much as possible under cover. When they have come up to him he

1. Points out the full extent of the target and apportions it among them.
2. Communicates sufficient of the General's tactical sketch to enable them to readily follow the proposed operation and thus, by knowing beforehand what is required of them, to be able, on receipt of an order from him, to turn their fire upon the proper portions of the target in succession according to the sequence of the fight.
3. Gives instructions if any special nature of fire is required of them, otherwise the choice of projectile is usually left to battery commanders.
4. Tells them what rate of fire is desired, *i.e.*, if a delaying action, slow deliberate fire to economise ammunition, if a decisive action, ordinary, or, in some cases, rapid fire to force a solution as quickly as possible.
5. Indicates to them the general alignment upon which he proposes that their batteries should take up position.

While the above instructions are being given to the battery commanders, the batteries in the preparatory position are being got ready, guns loaded and prepared, carefully inspected as to their fitness for immediate action, and depressed so that their muzzles may be in the correct position, or at least horizontal, when unlimbered (a saving of time with slow motion elevating gear, such as that of the Mark II. 12-pr. carriage), portable magazines and tube pockets filled, two of the case-shot brought from the wagon and placed upon the gun, etc.

The battery commanders having received their instructions as to target, position, etc. (to be dealt with more in detail hereafter) they will proceed to the places that they propose to occupy in action and thus mark for one flank of their batteries, they will at once communicate to their range-takers the portion of the target to which they desire the range to be found, and the latter will proceed with the operation. A signal is then made by each commander to his battery,

at which the sectional officers and gun-layers fall out to him, dismount, and approach him on foot, keeping under cover all the time, the last-named bringing with them their telescopic sights.

To these, battery commanders now communicate the following information, in which they will be greatly assisted by the use of a pointer, which defines objects much more graphically than any verbal description.

1. The full extent of the portion of the target assigned to the battery.
2. The ranging point, if any.
3. The nature and rate of fire and the flank from which it is to begin.
4. Any special orders on the distribution of fire.
5. Sufficient information to enable them to comprehend quickly, from a verbal order, which portion of the target to turn their fire upon when their mission is complete against the portion first engaged. This will also enable them to grasp more quickly what is required of them after advancing to closer ranges when the instructions given in a preparatory position are impossible.
6. The elevation for the first round. This is communicated last, for, while the previous information is being given, the range-takers will probably have had time to take the range and make their report. The elevation thus given is immediately set upon the telescopic sights, when used, and can be verified if necessary.
7. The general alignment of the battery.

They then spread themselves out along the position, keeping under cover, in rear of the places that their guns are to occupy when in action, approaching the actual firing position in a crouching posture, so as to be sure that the objective can be seen over the sights and at the same time avoiding being seen by the enemy. When these positions are selected, they must kneel or lie down in them and examine the target through their telescopic sights, thus making known to the battery commander that their positions are selected. When satisfied that all the positions for the guns have been taken up, battery commanders will signify the same to the Lieut.-Colonel by signal, the battery commander himself kneeling down is a convenient signal, the Lieut.-Colonel will then give the signal for the batteries to advance to the firing position. This they will do independently but so as to come into the firing position simultaneously, each gun being driven so as to come into action on the ground selected for it by its own layer.

When the ground is suitable it is convenient to reverse and come into action rear, and, if possible, and too much labour is not thrown upon the detachments, this should be performed under cover and the guns run up to the crest of the position by hand.

The guns are immediately layed at the elevation ordered. All instructions having been previously given, no word of command should

be heard until the new elevation, following the first round observed, is given.

It has been objected by those accustomed to the old dashing method of coming into action, that the above proceedings are lengthy and a waste of time. This, however, is not the case. At ranges of 2500 yards and upwards the position of the batteries is not generally disclosed, if reasonable precautions are observed, until they open fire, or perhaps, sometimes, until their simultaneous appearance on the firing position and then the sooner they open fire the better, and they are likely to do it quicker if they have been previously instructed rather than if these instructions are only communicated to them when in position. Considering the terrible ordeal of the artillery duel in which they are about to engage, and that "the choice of the first artillery position will frequently be decisive of the advance" (German Field Artillery Regulations, para. 265) it would be a piece of criminal carelessness if every possible step were not taken to ensure success before they are committed to the combat. No one can deny that it is easier to communicate detailed instructions to a small group in close proximity than to a battery at full interval, that has, perhaps, already drawn and is standing under the fire of the enemy, and "it must be well understood that regulations can only be quietly and accurately carried out so long as one is not under fire" (von Rohne). The eight or ten minutes employed in giving these instructions is but a small percentage of the time taken up by the artillery duel and is really a saving of time since, as all ranks come into position with a full knowledge of what is required of them, they are enabled to proceed to work more quickly and with greater confidence, and are thus likely to arrive at an effective fire much sooner than if they were hustled into position without being aware of the business before them. Besides this, in a great action, batteries are frequently detained for some time in preparatory positions while the whole of the artillery is being massed to the front and while the reconnaissance is being completed, the time at disposal would then be ample for these dispositions.

An axiom among foreign gunners is that "the best protection from the fire of the enemy lies in our own fire," therefore if we can be the first to open an effective fire the enemy are little likely to find even our range correctly, indeed, a German text-book goes so far as to say that "the victory will be to the artillery that first finds the range." All the more reason then that we should not enter upon this important process without first taking every possible step to compel victory.

In spite of the desirability of this detailed pointing out it will not always be possible, and this will generally be the case during the later stages of the fight, but it will often happen that instructions can be given before the fire has ceased on the first position, an advantage that will greatly accelerate the opening of an effective fire after the advance into the second position. Under such conditions it is desirable that the Lieut.-Colonel, having selected the firing position, should leave his Adjutant on it as a marker and himself return and lead his batteries into action, or at all events the leading battery to which the others should conform, in order that he may take full advantage of any

opportunity of describing the target to his battery commanders. The batteries being thus led straight into the firing position it rests with the descriptive power of the battery commander to rapidly describe the target.

Very few men are gifted with the power of graphically describing in a few words exactly the target and the portion of it upon which they wish the guns layed, and it is a matter of the greatest importance that this power should be exercised on every available occasion, for not only will it thus become increased, but gun-layers and sectional officers will soon become accustomed to any peculiarities in description and after a few days will readily pick out what is desired to be indicated. Halts on the line of march, or when halted in position, or standing fast during a field day are admirable opportunities for these descriptive exercises. For the above reason it is again apparent why intelligence as well as good eyesight is necessary on the part of gun-layers.

This hurrying of the batteries into action, without even a previous reconnaissance on the part of the commander, will often happen in the case of Horse Artillery when employed with cavalry; the time during which any fire effect is possible is so fleeting and the target is so unmistakeable, and at such a short range, that any detailed pointing out would be neither possible nor necessary.

"The deployment of a brigade division for action with a given simple and clear tactical idea, with a defined target, must be constantly practised, and, to be instructive, must be practised, or at all events discussed to the minutest detail. . . . Field days are, as a rule, little suited for this important exercise. The artillery duel, which is usually only indicated by a few rounds, in reality takes so much time to carry out that the loss of time arising from a quiet preparation for the occupation of the position would not be appreciable. The commander of a brigade division, however, who, on field days, wishes to make with his battery commanders an initiatory reconnaissance of the position to be taken up, a complete survey of the target, etc., would be certain to hear the reproach that his guns have appeared very late, if not too late. But, even if he is willing to incur this reproach, he would hardly have time to make a systematic division of the objective for at manœuvres everything is constantly on the move. The state of affairs, which often on the battle-field remains stationary for hours, changes here in the course of a few minutes. Changes follow one another as in a kaleidescope, and the eye in vain seeks for a stationary object in the general rush." (Von Rohne, "Regulation of Fire in Masses of Artillery.")

The following extracts from the German "Field Artillery Drill Regulations" will be of interest to compare with the foregoing:—

273. Every artillery position must be examined by the leader of the batteries who, for this purpose, should ride on ahead. He must avoid attracting the attention of the enemy to the position about to be taken up. The immediate inspection of the position should be accomplished on foot, according to circumstances, and accompanying persons (orderlies, trumpeters, etc.) should be left somewhat in rear.

283. Special stress is to be laid on the screened occupation of a position, and in opening fire in such a manner as will as much as possible surprise the enemy. When no cover is available this must be accomplished by quickness of movement.

284. Quietness and order should be kept, in order to facilitate a simultaneous opening of fire on the occupation of the first position in action; and next in importance after this is the occupation of a preparatory position under cover. The closer the latter position lies in rear of the firing position the better.

No hard and fast rules can be laid down for the formation to be adopted by batteries in this preparatory position.

In this preparatory position all preparations, such as the loading of guns, unless this has already been done as an exceptional case, setting of tangent scales, clinometers, etc., will be made; the section officers, gun-leaders and gun-layers will also be instructed as to the next task the battery will have to perform, IF THIS CAN BE DONE WITHOUT BEING NOTICED BY THE ENEMY.

286. . . . Battery commanders should not be sent for before the preparatory position is taken up. . . . In the firing position they must personally verify on foot, or by means of one of their dismounted attendants, whether the object to be fired at can be seen over the sights.

The commanders of brigade divisions who have already ridden ahead remain in the position selected and keep the enemy in view, while, as a rule, the battery commanders personally lead their batteries into action.

Whether the position selected should be marked, and how it is to be marked must be decided according to the circumstances of the moment.

287. In cases where the condition of the ground renders a more careful selection of the spots, where individual guns have to be unlimbered, necessary, the gun-leaders may be taken to the front for this purpose, should such a proceeding be possible of accomplishment unseen by the enemy. The gun-leaders seek out on foot the most suitable places for their guns. Equality in the intervals between guns is not insisted on. The section officers remain with the battery, the gun-leaders await on foot the arrival of the battery and give the necessary commands to their guns to halt and unlimber.

It may be pointed out, with reference to the last part of para. 287, in the British service the guns would receive the order in the prepara-

tory position to "Advance for Action," and on reaching their markers would unlimber and come into action, either to front or rear as indicated by signal, without any word of command being necessary.

289. On elevated positions the crest of the position must not be crossed before opening fire. The guns, having been unlimbered, will be run up by hand, as far as possible simultaneously, and so far as will just admit of the objective being seen over the sights.

To sum up the arguments for and against this pointing out of the target to everyone concerned, it seems that it should be done whenever possible, in order that we may take every advantage of the enemy before entering on the artillery duel, and that it will seldom be possible in its entirety at the later periods of the fight, and never in the case of Horse Artillery in cavalry actions.

AN HISTORICAL NOTE

REGARDING THE LATE

LIEUTENANT F. BAYLY, (H.P.), R.A.

BY

LIEUT.-GENERAL Sir R. BIDDULPH, G.C.M.G., C.B., R.A.

There are two interesting facts with regard to Lieutenant Frederick Bayly (h.p.), Royal Artillery, whose death is recorded in the Obituary, in "Proceedings" of R.A. Institution for December, 1891.

1st, He was the last surviving officer whose name appeared in the Army List as having fought under the Duke of Wellington. The last Waterloo officer in the Army List was General Whichcote, who died a few months earlier. Lieut. Bayly was the last who had the letter ‡ before his name; *see* the *Quarterly Official* and monthly Army Lists for October 1891, and the obituary in the December Army List (p. 798).

2nd, He was in the 101st year of his age, having completed his 100th year in July, 1891.

It seems desirable that the above facts should be noted in the "Proceedings" of the R.A. Institution, and so form a permanent record of two facts very interesting to future generations of officers of Royal Artillery.

His services, in the Official Quarterly Army List for October, 1891, are recorded as follows:—

"Bayly, F. (Lieut., *late* R.A).

Peninsular War, 1810–14. Battles of Busaco and Castalla. (Medal with clasp).

American War, 1814–15. Attacks on Baltimore and New Orleans (slightly wounded).

With the Prussian Army in 1815, taking of fortresses of Maubenge, Landrecies, Phillipeville, and Rocroy."

THE WORLD'S WAR-SHIPS,

FROM A GUNNER'S POINT OF VIEW.

BY

MAJOR W. J. ROBERTSON, R.A.

(Continued from No. 3, Vol. XIX.

Second Part—FRENCH.

It is but fair that I should state that the first number of this series, namely, "British Ships," was written originally to be accompanied with diagrams; these were found too expensive to print. The paper, therefore, is hardly as clear as it otherwise would have been. Reference, however, can easily be made to works containing them.

The new manual "Tactical Working Coast Artillery" had not then appeared. It enhances the value of distinguishing ships. This practice alone will enable one to do. I may, however, say that I found it easy by my notes this summer to make out the class of each British man-of-war touching in at this port.[1]

I ought also to add my thanks for the use I have derived from the photographs and descriptions of ships in foreign navies issued by the Admiralty, I was ignorant at first of the fact that they were for the use of officers generally and were not confidential.

The figures I have given are often only approximate—thus, in describing the weight of a ship's displacement in tons I have usually taken the nearest round number. The coal estimates for endurance are possibly over-estimated in the British ships, as well as the rate of steaming.

It will probably be news to many, brought up as most of us have been with the knowledge of Nelson's hatred to the French, and thorough contempt of foreign seamen in general, to learn that this dislike did not apply to material, and that in his day the French were universally acknowledged to be our masters in ship building. Thus the model of the 120-gun ship, Commerce de Marseilles, is yet to be seen in the

[1] Gibraltar.

Museum at Greenwich, was, in fact, thought worthy of a place in the Royal Naval Exhibition at Chelsea this summer, while our Admiralty even caused at one time a ship of 74 guns to be constructed on the exact lines of the French ship Belleisle, which we had taken from the French at Cape St. Vincent. I have, too, a vivid recollection, though I cannot turn up the passage, in "James' Naval History," of the way in which too many of these good sailors were spoilt in our hands by being re-armed with a much heavier armament. A fault which is still often alleged against the British Admiralty.

The French were also in advance of us in using steam motive power and in the introduction of the screw propeller, and, in fact, led the way in the matter of armoured ships. The idea of armour protection is said to have originated with floating batteries in the great siege of Gibraltar, but whether so or not it is undoubtedly to the initiative of Louis Napoleon that the modern birth took place. Five French floating batteries were commenced in September, 1854, and launched in the spring of the following year. They were all of the same size, length 172 feet, breadth 44 feet, and 9 feet draught. The thickness of armour was 4·5 inches, with 17 inches of wood backing. They are said to have done excellent service in the Black Sea, where they arrived 17th October, 1855, a week earlier than three English sister ships—the Terror, Thunderbolt, and Etna—built from the same designs lent by the French Government. None of these floating batteries are still in either service with the exception of the Terror, which, with its machinery removed, figures in our Navy List as at Bermuda. They were undoubtedly, however, a success, and to the French mind all that seemed necessary was to adapt their system of iron defence to ships of sea-going qualities.

Experiments were accordingly set on foot, and in March, 1858, the celebrated French Constructor, Dupuy de Lôme, commenced the first iron-clad frigate, the Gloire, quickly followed by the Invincible and the Normandie ; meanwhile the Constructor Audenet was permitted to build a similar vessel only of iron, to test a comparison with the three wooden frigates.

These four vessels were completely armoured above the water-line with five inches of iron, that being sufficient to keep out the projectile of a 68-pr., all that was then considered necessary. They had an armament of 36 5-ton guns, in a single broadside battery, extending along the whole length of the main deck; the ports, however, being only 6·25 feet above the water-line, they had constantly to be kept closed.

It was not till the Gloire was almost completed that we, who by no means favoured the new style of vessel, saw fit to lay down the Warrior, followed by the Black Prince.

Simultaneously with our Warrior the French began the wooden frigates Magenta and Solferino, very similar to the Gloire, except that the iron defence, though kept at five inches in thickness, was diminished in height at both stem and stern, but extended amid-ships to a height to cover a double-tier battery, of 13 and 12 guns on either side, of 5-ton guns.

These two ships were not launched till 1866, and though they remedied the fault of the Gloire type, it was at the expense of a large amount of wooden hull left exposed, accordingly in 1862 no less than 10 frigates of the Gloire type were commenced, named respectively, the Flandre, Gauloise, Guyenne, Savoie, Surveillante, Provence, Magnanime, Valeureuse, Heroine, and Revanche.

Their length was 262 feet, breadth 56 feet, displacement nearly 6000 tons. Their armour was six inches in thickness at the belt, diminishing to 4·5 inches at the top of the battery. The last of this type was finished in 1867, and, owing to the slight attention paid to the modifications that were taking place in naval guns, were obsolete—as Lord Brassey informs us—before they were even completed.

Of this first group of six ships none now remain in the French service; of the second of ten vessels, four have disappeared, three are marked as unfit for service or repair, three, the Savoie, Heroine, and Revanche, are still in their service. They are now armed with eight 24 cm 16-ton B.L.R. guns, three 19 cm, and four 14 cm ditto. The first is provisionally condemned, the second it is proposed to convert into a gunnery ship, the third is, I believe, employed at Algiers as a floating depôt. I think we may, therefore, set them all three as beneath further attention.

A type of a second-class line-of-battleship was also determined for foreign service. These were again very similar in form to the Magenta and Solferino, but with only one tier of guns. They were only 230 feet long and not quite 4000 tons displacement. They were also ten in number, but of these only six, the Alma, Belliqueuse, Atalante, Montcalm, Reine Blanche, and Thetis, remain in the service, while all but the Montcalm and Reine Blanche are stated in their estimates as unfit for further service or repair.

It may be asked why such a large number of these frigates and "corvettes cuirassées" are kept on in the service if in such a bad and useless state, but the French have been singularly unfortunate in their early iron-clad fleet, and while they have no vessels of the date of ours yet fit for further service like our Achilles, Agincourt, Hercules, Minotaur, etc., etc., they have failed, as they had hoped some four years back, to dispose of these vessels by sale.

The second group of first-class line-of-battleships was followed by a third of four vessels, the Océan, Marengo, Suffren, and Friedland. The Océan was 20 feet longer than those of the second, and 1500 tons more displacement. The armour was eight inches at the water-line, and protected by 35 inches of backing. The armament was mounted in a central battery, on the four corners of which were barbette towers projecting beyond the sides of the ship. The armour of the battery and turrets is 6·5 inches. However, long before the ship could be launched her iron defence had ceased to give protection against the 23-ton guns then in use.

This ship is noticeable as the first sign that the French had shown, that unlike the old wooden vessels, the iron-clad fleet would have to consist of craft of various types and designs for different services. It was the early realisation of this that has given us such a start of our

Gallic neighbours. They, however, still clung to the old ideas, and all the four ships may be fairly considered as sisters, though the Friedland is larger, and differs in some other respects. They are armed with four 27^{cm} 23-ton guns and four 24^{cm} 16-ton ditto; besides smaller weapons, with the exception of the Friedland, who has eight of the former weapons. The armour has now been removed from the barbettes owing to want of stability, but the guns are protected by shields. They should be easily recognised by their three masts, the foremast square rigged, the others fore and aft. Funnel rather large, round, with two telescopic steam pipes, between fore and main masts, and above all, by their barbettes, which are on either side of the funnel and near together. They have also a stern walk and ram bow. In the Friedland the central battery is longer and consequently the towers further apart, she has also a conning tower, while the funnel is oblong, and there is a wide space between the fore and mainmast. Again, they have single screws, which leaves a different wake in the water to twin screws.

It may be observed that with this third group the French for the first time departed from their broadside ships. The central battery is enclosed in a box similar to our Bellerophen or Hercules.

These ships were followed by a fourth group, the Richelieu, Colbert, and Trident, plated with nine inches of armour.

The Richelieu is of a type very similar to that of the preceding group, but with an addition of 33 feet to her length and 1200 tons to her displacement, *i.e.*, 323 feet long, 58 feet beam, 9000 tons displacement.

She has six 23-ton guns in her central battery, and four 24^{cm} in her barbettes, with a fifth, mounted as a bow chaser, firing directly ahead from under her bowsprit. She carries a secondary armament of eight 14^{cm}, besides Maxims. She is rigged with three military masts with double tops, has a slightly raking oblong funnel near and before mainmast, and close abreast of her foremast barbette towers. She has a ram bow and high topgallant forecastle.

The other two ships, the Colbert and Trident, had some considerable changes introduced. The central battery was reduced to six 23-ton guns, thus bringing about a saving in the length of 39 feet. The towers were reduced to two to allow of the same heavier guns being mounted—the stern turrets being dispensed with, as also the armour of the remaining ones. In the stern an additional 15·5-ton gun was introduced, firing direct with the line of keel. A knot of extra speed was thus gained. All these three ships have their hulls constructed of wood, except the extremities fore and aft, in which the upper works extending beyond the central battery are of iron.

The last two were not completed till 1877. They have three masts, the foremast square rigged. The funnel is before the mainmast between the barbettes and behind a high conning tower and bridge which is much exposed. But the most distinguishing mark is a very sloping stern which, if it were not for the stern walk, would look like the projecting bow of a ram.

With the insignificant addition of some smaller vessels for coast

defence, the Belier, Boule-dogue, Cerbere, Onondaga, Taureau, Tigre, Imprenable, this completes the iron-clad French fleet up to the time of what is termed the 1872 programme—a land-mark in their ship-building policy. All these coast defenders we shall, with other nations, be able as land gunners to ignore. Owing to the proximity of the French coasts we must take theirs alone into account. But as those just named are all marked as unfit for further service, we can, in this instance, afford to ignore them.

To recapitulate, out of the four groups of first-class line-of-battle-ships, the first are extinct, the second practically so, the third have four vessels, and the fourth three.

Captain Nash shows these seven vessels under the one head of six inches of vertical armour, and as penetrable at 4200 yards by our 9-inch M.L. and 3600 by the 6-inch B.L. This is correct, but only when read in the light of his head-line, namely, "Iron Protecting Chief Armament." It is, in fact, their central battery, but it would be very misleading to any one ignorant of the system of armour defence. In the first three ships, the Océan, Marengo, and Suffren, a rectangle of the length of the vessel, and three feet above the water-line and five feet below (eight feet in all), consists of iron varying from seven inches to eight inches; in the Friedland, of the same length, but only one foot nine inches above the water-line and five feet below (six feet nine inches in all), of a thickness from seven to eight inches. The Richelieu is similar, only the armour is nearly nine inches thick in places, while the Colbert and Trident have a belt three feet three inches above the line and four feet nine inches below, of the same thickness as the former ship.

Thus, for instance, supposing a bombardier's cap represents the ship, the cap-band the iron belt, and the chevron[1] the citadel, at 4000 yards the 10-inch M.L. and the 8-inch B.L. will penetrate the belt of the first four ships, *i.e.*, the cap-band, the latter gun only in the last three ships. While even such pieces as the 80 and 64-prs. would do great damage to the bulk of the whole seven ships represented by the blue cloth. While on this subject—truly a gunner's question—it would be interesting to know on what experiments Captain Nash's dicta in favour of common and shrapnel shell is based, in the attack of unarmoured vessels and the unarmoured parts of armoured ships.

At the battle of Alexandria the failure of the heavy R.M.L. projectiles to burst was attributed, I think, to the inaction of the fuzes. Scores of them unexploded were to be seen, I am told, although many had struck solid masonry, notably the Mosque in Fort Pharos. Were the shell which destroyed the Turkish fleet at Sinope unfuzed? and were those shell which created such havoc in the Resistance plugged shrapnel? *See* "Brassey's Annual, 1890," page 190. It is new to me that a percussion fuze breaks up a shell before it has entered an unarmoured vessel's side. Captain Nash seems to place a low estimate on the combustible and concussive effect of a large bursting charge between decks, as he prefers plugged shrapnel. Surely if they break

[1] The chevron is hardly large enough in scale.

up after their velocity has been much reduced they will be of very little account.

Before dismissing from our minds these vessels, it may serve to identify them to recall that the Marengo was Admiral Gervais' flagship at Portsmouth, and that the Suffren sustained severe damage on a rock off Toulon in 1885, and that in the same port the Richelieu had to be scuttled in November, 1880, to extinguish a fire on board and was not raised till March, 1881.

This is a list of the armoured French fleet that we have been considering.

FRENCH ARMOURED SHIPS.—FIRST PERIOD.

Line-of-Battleships.—First Class.

1st Group.—Gloire, Majenta, Invincible, Solferino, Normandie, and Couronne.
2nd Group.—Flandre, Gauloise, Guyenne, Savoie, Surveillante, Provence, Magnanime, Valeureuse, Heroine, and Revanche.
3rd Group.—Océan, Friedland, Marengo, and Suffren.
4th Group.—Richelieu, Colbert, and Trident.

Second Class.

Alma, Belliqueuse, Atalante, Montcalm, Reine Blanche, Armide, Jeanne D'Arc, Montaubon, and Thetis.

Coast Defenders.

Belier, Taureau, Boule-Dogue, Tigre, Cerbere, Imprenable, Onondaga, and Protectrice.

Carried over as Still Efficient to Second Period.

Océan, Marengo, Suffren, Friedland, Richelieu, Colbert, and Trident.

FRENCH IRON-CLAD FLEET.—SECOND PERIOD.

The programme of ship building for 1872 starts a new epoch in the history of the French fleet. Driven from the proud position they had so long held, of pioneers in ship construction, the French bravely looked their difficulties in the face after the disastrous war, and drew up an extensive and far-reaching programme. It was to comprise ten first-class ironclads, seven second-class, and ten coast defenders, which included completing the vessels in hand, which for the sake of clearness we have already considered.

In regard to the general arrangement of the different types of ironclads, it was decided that for the future iron alone was to be used for the hull and decks, principally because iron admitted of readier repair, while it facilitated numerous water-tight compartments—a special feature of these intended ships. It was also determined to increase the deck armour owing to the powerful plunging fire that some of the English ships especially were able to deliver. It was not long before steel began to be substituted in many instances for iron. The new era was also characterised by an increase of displacement and a reduced draft of water.

Foremost among the new ships came the Redoubtable, constructed from the designs of Mons. de Bussy ; she was commenced in Novem-

ber, 1872, and completed in December, 1878. She is 318 feet in length, 64 in beam, and 9000 tons displacement.

The hull is of steel, the plating of iron. The armour is arranged in a water-line belt running right round the ship and extending well down over the point of the ram, which weighs 30 tons. It is 14 inches thick amidships and nine inches fore and aft, and five feet both above and below the water. In the central part of the ship is an irregular octagonal battery, carried up from the main to the upper deck. The sides of the ship before and abaft this battery tumble home considerably.[1] This permits of a fore and aft fire from the protected guns within it. The sides and bulkheads of this central battery are 9·5 inches thick; there are no doors to it—entrance having to be obtained from above. On this again are two heavy guns protected by a thin screen of iron, over which they fire *en barbette*. The height of this gun platform is 20 feet from the water. She has also a pear-shaped barbette for a stern chaser quite aft, and a bow chaser under her bowsprit. This accounts for eight 27^{cm} guns. There is a secondary armament of six 14^{cm} guns on her upper deck. The engines have developed a speed of over 14 knots (twin screws), but have only a coal consumption of 2800 knots at 10-knot speed.

In general appearance she is not unlike our Audacious class, Iron Duke, Invincible, etc. The central battery is very prominent, with a very large tall oblong funnel right between the two centre barbette towers. Her stern is sloping and rounded, with a stern walk. She has three fully rigged masts. The mainmast in her very centre just inside the battery, the foremast square rigged and well forward, the mizen nearer the mainmast than the stern.

The Redoubtable was followed by two larger sisters, for though of the same length they have nearly 10,000 tons displacement. The construction is the same, the armour on the belt being increased in mean thickness though not in maximum. The Dévastation is slightly the larger, and can steam 15 knots to the 14 of the Courbet. They are similarly armed with four 34^{cm} 48-ton B.L.R. guns in their battery. The rest of their armament is the same as that of their predecessor. At first they were fully rigged, but have now only military masts placed or cut down from the original ones, which are similarly placed to those of the Redoubtable. Each mast has two tops, the lower for four Hotchkiss, the upper pierced for musketry. There are two oblong funnels placed abreast in the Dévastation, and four in the Courbet, but to ordinary eyes the latter would look more like two abreast, as the casing is carried so high up.

I attach but the slightest importance to rig in distinguishing ships, as it can be so easily altered and disguised; it is, however, different with the position of the funnels and masts, which remain in the same places.

The position of the funnels in these three ships is in the same transverse line, namely, the very centre of the battery.

The Courbet was originally named the Foudroyant.

[1] "Tumbling home or falling home—the inclination of the top side from a perpendicular towards the centre or middle line of the ship."

A new departure was proclaimed by the laying down of the Admiral Duperré, by M. Sabattier, in December, 1876. While we had been drawing more and more to reducing the armoured belt to a minimum in length and to a maximum in thickness, the French here determined to concentrate the armour on the belt, which should again run round the ship, and abandon the armoured central battery. Hence their mounting the heaviest guns in barbettes, and carrying only light guns on their broadsides. The details of this ship is, therefore, well worth mastering.

She is 311 feet in length, 70 feet beam, and 11,000 tons displacement, and was completed in 1883. The belt is one foot six inches above the water, and six feet seven inches below, varying from 22 inches amidships to 10 inches fore and aft. An armoured deck of 3·15 inches of metal, fits entirely over the belt, flush with its upper edge. From this rises four barbettes, two of which project from the sides of the ship and afford a means of firing direct from the line of keel, the other two are placed in the centre line of the ship on the upper deck. These turrets are carried down to the armoured deck, and are protected with 12-inch armour. In addition to this the funnel and other communications are also protected with circular 12-inch iron. This was looked on as important, as it was thought that in a ship like our Nelson or Shannon, for example, a projectile making an opening in the funnel casing would fill the battery with smoke and make it impossible to remain there. No doubt our Welsh coal makes this less of a difficulty than with other nations. Here at Gibraltar the difference in smoke between foreign and our own war-ships is most marked.

The armament is one 34^{cm} 48-ton B.L.R. gun in each barbette. They take four minutes to load, but the after one trains the whole sweep of its 270° in 32 seconds. There is a 16^{cm} gun under the top-gallant forecastle, and 14 14^{cm} guns mounted on the main deck, between the main and mizen masts. The speed and coal endurance is about the same as in the last class. As regards general appearance, she has a long ram bow with a nearly horizontal bowsprit, a sloping stern falling in, with stern walk. She has three military masts, each with two fighting tops, the masts being hollow to serve as lifts for ammunition. The mainmast is exactly in the centre of the ship, the mizen half-way between it and the stern, the foremast much nearer the bow. Half-way between these two masts are the side towers, the centre two being fore and aft of the mizen. The funnels are two abreast, oblong, large and high, close abaft foremost barbette towers. There are two conning towers which stand out well, the upper being above the side barbettes, the other on the top of what is really an armoured room on the main deck just in front of the mizen.

The sweet simplicity of the first period of ship building has now given way to a constant change of design even in the same type. The French had thoroughly learnt the lesson they had neglected at first. Nor is it surprising after the leap made at one stride to the Admiral Duperré, that the two next sister ships varied considerably.

The Admiral Baudin, although laid down in 1879, was not completed till 1888. In size she is very similar to her forbear, only that she can

steam 15 knots. She is built, however, entirely of steel, with steel armour. The belt is much the same as in the other Admiral. The turrets are allowed an inch more of protection. The chief difference is that there are only three turrets, and these are placed in the line of keel, each containing a 75-ton gun. One is up in the bow, one amidships, and one towards the stern; the secondary armament is not much altered. The turrets, or rather barbettes, do not extend, I think, in the same way to the armoured deck. There are two military masts very high indeed, each with three fighting tops, and a very large round funnel rising out of a high superstructure or bridge between the centre and fore barbettes.

The sister ship, the Formidable, is similar in every way, but has one more inch of steel in her barbette armour.

These three ships are particularly interesting from a gunner's point of view. From a fort on the water's edge there would be little steel to aim at. At 2500 yards (probably nearer) both the 12·5-inch M.L. and 9·2-inch B.L. would fail to let water into them. But, on the other hand, even pieces of smaller nature would probably jamb their turntables if the tower was hit at its junction with the deck, at least I think that is the naval idea. But a number of small guns, and more especially quick-firers, would also inevitably, in my opinion, drive them to long ranges. The whole of the ship above water, with the exception of the barbettes, would be penetrated by even a common shell from a gun like the 4·7-inch B.L. Such projectiles, if poured in sufficient quantities into a ship, would do great and even often terrible damage, steam pipes would burst, auxiliary engines get out of order, lifts jamb, crew suffer, etc. In many cases the secondary battery would look like a butcher's shambles. It is for reasons like this that we are, I think, often led astray by penetration tables. Thus, that in "Brassey's Annual" gives only the 16-inch M.L., 17·72-inch M.L., 13·5-inch B.L., and 16·25-inch guns, as penetrating the sides of these three ships. Even officers get an idea that with smaller guns it would be useless to attempt much, while the men would, unless controlled, simply fire at the belt or big guns, or else leave the ship alone for a smaller craft. I doubt, too, if our necessity for Q.F.'s has been yet recognised, the 4·7-inch Q.F. is a very common gun at sea, but there are very few on land.

While on this subject the deck penetration of the 6-inch B.L. from elevated batteries is worth looking at. At from 1500 yards the 6-inch B.L. guns on the top of the Rock would penetrate even these metal decks, and the 9·2-inch would do the same at a very long range, while a deck is a target one can hardly fail to hit each round. The possible loss of a ship costing some £800,000 will deter foreign Governments from risking so much unless with a very definite object.

Let us now turn to the second-class battleships. It will be remembered that one group only had been built of these, for use on foreign stations. They were very similar, though smaller, to the old Magenta and Solferino. They are now beneath our notice. Of this the Alma type, three, the Victorieuse, the La Galissonniere, and the Triomphante, had been begun before the 1872 programme. I cannot account for

the great delay in their completion. The Victorieuse was commenced in 1869, but only finished in 1877, she was a little larger than the old Alma, with better engines. To carry a better armament, two small barbettes protrude over her sides, each carrying a 24^{cm} gun, with four more of these pieces in her central battery on the main deck. The belt and battery were left of the same thickness, six inches and 4·5 inches.

The other two vessels are precisely similar; they were begun in 1868 and 1870, and finished in 1877 and 1880 respectively. They are such poor vessels of wooden construction and weak defence that they are hardly worth our consideration, as they are not likely to be left much longer in the service.

Lord Brassey, I observe, now ranks them as armoured cruisers, but their coal endurance is not great enough to make them useful as such.

An improvement on this group is the Duguesclin, built of steel. She is 1800 more tons displacement, making it close on 6000 tons. The belt being increased to 10 inches and that of the barbettes to eight inches. The general arrangement, however, is that of the Admiral Duperré. The armament is a 24^{cm} gun in each of the four barbettes, a 19^{cm} gun under the forecastle, and six 14^{cm} guns on the main deck. It will be remembered that the Duperré was first fully rigged before three military masts took their place, consequently her smaller and weaker sister was rigged as a brig with royals. These yards and upper masts have been since removed. She has a peculiarly sloping stern, tumbling home in a remarkable manner, one round telescopic funnel abaft, but not clear of her foremost barbettes. Her masts, however, would distinguish her from the proper Admiral class.

A sister to the Duguesclin is the Vauban, similar in every way.

There are also two similar ships to these, the Turenne and the Bayard, only built of wood. It is easy to remember that these four Generals are copies of the Admiral class. As cruisers their weak point would be their lack of coal, which, however, is assisted in the two last ships by being fully rigged as ships with royals, which still remain. I believe the Turenne is only calculated to carry sufficient coal for three days five hours, or under 1100 knots. The Bayard can but carry 400 tons, while her consumption at 14 knots is 110 tons a day and at 12 knots 54 tons.

With regard to coast defenders, it must be borne in mind that by this term the French include vessels capable of rather more extended use than we attach to the term "coast defence vessels."

Of the group prior to 1872 none uncondemned remain. The first of the new group is the Tonnerre, commenced in 1873 and completed in 1879.

She is not unlike our Glatton, but nearly half as large again. Thus she is 248 feet long, 58 feet beam, and nearly 6000 tons displacement. Her low hull is armoured all round the sides and ends with from 13 inches to 10 inches of armour, her deck is slightly curved, and is two inches thick. The redoubt or central breastwork covers about half the deck in length and two-thirds in breadth. On the fore part of this again is a circular revolving turret taking two 27^{cm} 28-ton guns.

The armour of the redoubt and turret is 13 inches and 12 inches. Behind the turret is a high superstructure similar to that of our own vessels, like the Rupert or Glatton, from which is a signal pole as a mast. The funnel is large, oblong, and almost exactly amidships, with a cup-like or protruding rim round the top of it. As the distance between the guns in the turret is greater than the breadth of the superstructure, it was intended to be able to fire right aft. This was tried in 1884, but blew away a considerable part. The turret can turn round the 360° in 50 seconds. The freeboard is only three feet—the redoubt is six feet six inches in height. The hurricane deck, though only eight feet wide, is very high and projects, and has a small secondary armament.

Following the Tonnerre came the Fulminant, sufficiently similar to be termed a sister. Then the Furieux, with armour increased to 18 inches amidships on the belt, and with the redoubt replaced by the ship's sides, being carried up, so as to give greater freeboard. The single turret was replaced by two pear-shaped barbette towers. The superstructure was no longer needed, and a hurricane deck was raised to but very little above the towers. There is a single military mast, with a round funnel just before it, and a very large and prominent ventilating shaft behind.

She has a single 34^{cm} 48-ton gun in each barbette. This ship formed one of the French fleet at Portsmouth. She can steam 14 knots, and has a coal endurance of 1400 knots at 10-knot speed. The steel deck is over three inches thick.

Of the second-class Gardes-côtes, but three exist. The Tempête and Vengèur are sister ships, very like the Tonnerre both in design and appearance, though 1200 tons less displacement; they are the same length and breadth, but draw only 17 feet of water instead of 21 feet. The former has the same guns as the Tonnerre, the latter carries two 48-ton, like the Furieux. I don't think they could be distinguished from the first group. The Tonnant resembles the Furieux, and has the same armament, but having her funnel right amidships serves to mark her.

The 1872 programme naturally got modified as years passed by, it will be convenient to take a review of the armoured fleet as far as we have got, placing the remainder in a third or modern period.

It will be remembered that we carried on but seven ships from the first period, viz.:—The Océan, Marengo, Suffren, Friedland, Richelieu, Colbert, and Trident. Of these only the Friedland was an iron ship.

SECOND PERIOD.

Line-of-Battleships.—First Class.

1st Group.—Redoubtable, Dévastation, and Courbet.
2nd Group.—Admiral Duperré, Admiral Baudin, and Formidable.

Second Class.

1st Group.—Victorieuse, La Galissonniere, and Triomphante.
2nd Group.—Duguesclin, Vauban, Turenne, and Bayard.

COAST DEFENDERS.—FIRST CLASS.

1st Group.—Tonnerre and Fulminant.
2nd Group.—Furieux.

SECOND CLASS.

1st Group.—Tempête and Vengeur.
2nd Group.—Tonnant.

All these vessels are carried on to the third period.

FRENCH IRONCLAD FLEET.—THIRD PERIOD.

The simplicity of the new programme of ship building is not increased by the various classifications given by different, and even in some cases, the same author. Thus the same vessel figures as a line-of-battleship, as an armoured cruiser, and even as a Garde-côte, according to the book one opens. The names, too, of the ships often tend to mislead one. Thus, in the first group of line-of-battleships which we have now to consider, the Hoche, Neptune, Marceau, and Magenta, would hardly be thought to be sisters.

The third was lately at Portsmouth, the second and fourth are not yet quite completed. I suppose they may be termed improved French Admirals. They are about the same size as these ships, but can steam 4000 knots instead of 3000 at 10-knot speed. The lower part of the Neptune, which is the pioneer of the class, is of iron, the upper of steel. The system of compartments is carried to such an extent that it is claimed that the utmost amount of water that would be admitted, if struck by a torpedo, is limited to 250 tons.

The belt, again, runs round the ship seven feet four inches in height. It is 18 inches amidships to 12 inches aft. This is less than in the Admirals. There are four barbettes, protected with 16 inches of steel. These are placed differently to either of the preceding types. Two are in line with the keel, one fore and the other aft. Two are amidships, and project over the sides. They each contain a 34^{cm} 52-ton gun. There is a secondary armament of 17 14^{cm} 2·5-ton guns placed on the main deck. There are two military masts with double tops. The foremast is placed just on the forepart of a high superstructure. The funnel is large and round, and very high. The ship falls in or tumbles home very much above the armoured deck, which is 3·6 inches thick. These ships should be very easily recognised by the position of their barbettes. The two amidships are almost exactly the centre of the ship and stand out very plainly. They could not well be mistaken for any other class. They are usually considered exact copies, but the Hoche is not quite like the other three, and has only 28-ton guns in the amidships barbettes, which are higher and smaller. She has also a double and higher superstructure.

We now arrive at the names of two ships that are puzzling. The Brennus and the Charles Martel. The first was begun, without doubt, in June, 1885. In the following March building was suspended till January, 1888, when it was again recommenced on a new design. In January, 1889, an entirely fresh scheme was commenced, perhaps the material being re-made up. On the 1st January, 1892, the advancement in hundredths is shown as only to be 62. Hence nearly every

book bearing on the subject presents a different plan of this much delayed vessel. She will be of about the same size as the class just considered, but beyond this it is fairly vain to speculate. The Martel is not quite so bad a case, but has much the same sort of history, and is only to be advanced up to six-hundredths by 1st January, 1892, and only quarter built by 1st January, 1893.

Two other first-class battleships are in progress, the Jauréguibery and the Lazare Carnot. They are to be 12,000 tons displacement, 356 feet long, and 72 feet beam.

The armoured belt is to be 18 inches thick in maximum, four turrets for the principal armament, and four, with two 14^{cm} guns in them, for secondary, doubtless the guns will fire over them *en barbette*. They are to steam 17 and 18 knots. The first has, I believe, not yet been begun, and only five-hundredths is to be advanced in 1893, the latter is in about the same state as the Martel.

One of their features is that electricity is to be used instead of hydraulic power.

Turning to the second-class battleships we get a group of four, the Terrible, Indomptable, Requin (Shark), Caïman. It is again confusing that these ships which here figure as second-class battleships are only bigger and improved editions of the coast defenders, considered in Period 2.

The last of that batch was the Furieux. On this was built the Terrible, then the three others identically sisters. As a proof that they are rightly classified here, it may be noticed that the Requin, as well as her forbear, the Furieux, came to Portsmouth this summer with the French fleet.

Their displacement is 1600 tons more than the first group, making over 7000, 280 feet long, 60 feet beam. They can steam 14 knots, but their coal endurance is still small, 2680 knots at 10-knot speed. They look more like sea-going ships than the Furieux, the freeboard being again greater, while the two turrets or rather barbettes are nearer the bow and stern. To look at they are more after the style of our Admirals. The belt is increased to nearly 20 inches, diminishing at the ends to eight inches, and is two feet eight inches above the water and five feet below.

The barbettes have 18 inches of compound armour, and contain a 42^{cm} 75-ton gun, for secondary armament four 10^{cm}. As regards recognising them they have a ram bow with spur; the side is carried up to the spar deck amidships, thus looking as if it was a central battery. There are four funnels, but looking like two abreast, except in the Requin, where the casing is not carried up so high. The position of the funnels is a little to the bow of the centre line. In front of these there is a large deck-house on the spar deck. The stern is circular. Unlike the class from which they emanated, they have two military masts, with single tops.

The French would still, I fancy, count these four vessels as Garde-côtes which, as has been explained, embraces a wider usefulness than we attach to it. With them second-class battleships were originally intended for foreign service; of recent years these have been termed

with us armoured cruisers, and second-class battleships those forced from the first line, such as our older craft. The French have now begun to adopt the term "armoured cruisers." Of these two types are being built, one the Dupuy-de-Lôme, will be finished in another six months or so, the other—the Bruix type—to consist of the Charner, Bruix, Chanzy, and Latouche Treville. Of the first only 35-hundredths, of the second eight-hundredths, will be completed by 1st January, 1892. The other two are being built by contract and should each, by 1st January, 1892, be advanced 64-hundredths.

The Dupuy-de-Lôme is intended as flag-ship on the China station, and being 376 feet long, 51 in beam, and over 6000 tons displacement, with a speed of 20 knots per hour, and a coal endurance of 4000 knots at half that speed, will compare favourably with our Aurora, Immortalité class, though they can steam 8000 knots, if not quite so fast. In protection, however, she is very different. She has a high belt of armour, four inches thick, running right round her, and two projecting barbettes amidships for her main armament.

The Bruix type are very long narrow ships, with a much narrower belt, slightly thinner; their displacement is under 5000 tons. They will have a large barbette bow and stern, and six smaller ones at the sides.

There is yet another group of four vessels, the Tréhouart, Bouvines, Jemmapes, and Valmy, named after Republican victories, which must be placed among future coast defenders. Lord Brassey remarks of them :—

> "These ships, at first called battleships, are really coast defence ships of a powerful type."

They have been developed from the fruitful Furieux, and are identical in all respects. They will be 283 feet long, 57 feet beam, 6600 tons displacement. They will apparently be not unlike the Requin class, only with two closed turrets.

They are none of them likely to be completed in 1892.

There are only two groups of gunboats to be noticed now among the armoured class. In the first group is the Acheron, Cocyte, Phlegeton, and Styx, all of the same design and size. The last two are not yet completed, while the first is condemned. They are 181 feet long, 40 feet beam, 1640 tons displacement. True to the French plan, there is a belt of armour 4·9 inches high and of a uniform thickness of 7·87 inches. In the bow is a single closed turret for one 27^{cm} 27-ton gun. The thickness of its armour is eight inches. It can fire through an arc of 270°. In the two older vessels there are two 10^{cm} guns, fired from small barbette towers amidships. The newer craft have one 12^{cm}, firing aft.

The general appearance is fairly marked. A low freeboard from stem to turret, then high from turret to funnel, and lower from funnel to aft. Stem straight. Mast in the centre, funnel abaft the mast.

The second group comprise the Flamme, Fuzee, Grenade, Mitraille. All completed. Length 165 feet, beam 32 feet, displacement 1000 tons.

There is a belt with a height along the sides of 33 inches, and eight inches thick amidships to four inches aft. A fixed barbette tower

with a high protecting shield in the bow for a 24^{cm} 16-ton gun, and a 9^{cm} gun projecting over the stern.

In appearance the upper deck is flush, with wings at the tower for a breakwater. There are two masts, with an extremely high, thin funnel well to the stern, though forward of the mainmast.

This completes the French armoured fleet. I again append a list:—

THIRD PERIOD.

Line-of-Battleships.—First Class.

1st Group.—Hoche, Neptune,* Marceau, and Magenta.*
2nd Group.—Brennus* and Charles Martèl.*
3rd Group.—Jauréguibery* and Lazare Carnot.

Second Class.

Terrible, Indomptable, Requin, and Caïman.

Armoured Cruisers.

Dupuy-de-Lôme,* Bruix,* Chanzy,* Charner,* and Latouche Treville.*

Coast Defenders.

1st Group.—Tréhouart,* Bouvines,* Jemmapes,* and Valmy.*

Gunboats.

Achéron,*d* Cocyte, Phlegeton,* Styx,* Flamme, Fusée, Mitraille, and Grenade.

N.B.—Those marked with an asterisk are only building. *d* means condemned for further service.

PROTECTED CRUISERS.

It was the American War of 1863 that gave rise to the class now termed armoured cruisers. These we have already considered, the dividing line between them and the protected cruisers is, however, slight; generally ships provided with only horizontal armour are classed with the latter.

It is clear that these ships are not intended to engage forts, and will, therefore, only be very casually touched upon.

It is to the exertions of Admiral Aube and the late Mons. Gabriel Charmes, that the French largely owe their fleet of protected cruisers. The policy they so strenuously urged may be summed up in their own words, "Mercilessly attack the weak, without shame fly before the strong." Accordingly a large number of these ships were laid down; in fact, all we have here to notice date from this period, with the exception of three new ships about to be built and one laid down before, viz., the Sfax.

This vessel, commenced in 1882, had her first trials in 1887. She is 289 feet long, 49 feet beam, 4488 tons displacement. She is built of steel frames and iron plates, with a protective deck of steel 2·36 inches thick. She carries six 16^{cm} 5-ton guns on her upper deck, two

in embrasure ports under forecastle, four in what are termed flat sponsons, which may be described to the lay mind as flat brackets projecting from the sides. These are abaft the foremost funnel and before the mizen. On the main deck between these sponsons are five 14^{cm} guns on either side. In general appearance, she has a poop and topgallant forecastle, with a long ram bow with spur. Barque rigged, though she has fighting tops. Her main and mizen masts are very close indeed together, which gives her a curious appearance. Two round funnels, the after one well before the mainmast. She has steamed close on 17 knots, with a coal endurance at the usual speed of 4000 knots.

This first-class cruiser was followed by the Tage, begun in 1885, completed in 1890. She is much bigger, 7045 tons displacement, 390 feet long, 54 feet beam.

Her speed has been increased to 19 knots, her coal endurance is not known, but she carries about the same amount as our Edgar class, which is estimated as 10,000 knots. She has an arched armoured deck, at sides 2·2 inches thick, it runs the whole length, and is four feet three inches below the water-line at the sides. She is also protected by a coffer-dam three feet three inches wide, which runs round her between the armoured deck and the lower deck, this is filled with cellulose. The space above this is taken up with coal and stores. Her armament is similar and placed the same way as that of the Sfax. She is very long, low in the water, and has a ram bow and horizontal bowsprit. Three light masts, the former with yards. All three with fighting tops. Three funnels between fore and mainmasts, which have an inverted bowl, so to speak, at the top.

The Cecille is a little smaller, 5766 tons displacement, 378 feet long, 50 feet beam. She also can steam 19 knots. She is very similar to the Tage and carries the same armament, but has no coal above the protective deck. She is higher in the water to look at than the Tage, and her three funnels are much larger and without the rim. Lightly rigged as a barque, no royals. She carries much less coal, estimated at 3500 knots at 13-knot speed.

Smaller again is the Jean Bart, completed in 1890; 4160 tons, length 346 feet, and beam 43 feet. She differs a good deal from the above ships, as she carries all her armament on the upper deck: four guns in angular sponsons on either side, one gun under topgallant forecastle, and one right aft on the poop. These two are 14^{cm}, as are also those in the four centre sponsons, while there are four 16^{cm} in the outer sponsons. She is rigged as a barque without royals; has two oblong funnels dividing the space equally between fore and mainmasts. The first pair of sponsons are abreast of the foremost funnel, the next just abaft the after funnel, the third close to it, just in line with the mainmast, the last half-way between main and mizen masts. Sisters to the Jean Bart are the Isly and Alger. The last is just about completed, the Isly is not above half built.

This completes the first-class protected cruisers.

Of the second-class there are but two sister ships, the Davout and Suchet, the latter will be only half built by 1893. The Davout is

lately finished. She is 3027 tons displacement, 297 feet long, 40 feet beam. I believe she has steamed 20 knots; 6000 tons endurance at half speed. At the sides the protective deck has been increased to close on four inches in thickness, but is otherwise the same. She has a main armament of four 16^{cm} guns; one right in the bow, another right aft; two in flat sponsons abreast foremost funnel. She has also four 47^{mm} Q.F. in similar sponsons abaft the after funnel. A long pointed narrow bow. Her funnels are oblong and high between her two masts. These masts and funnels pretty well divide her length into six fairly equal spaces. Her iron masts are peculiar—very large, with double tops and a pole not one-tenth the diameter of the mast hoisted above the upper tops. The conning tower is round the foremast.

Three other second-class cruisers are to be built, the Bugeaux, Chasseloup-Laubat, and the Friant, but the tenders had not been accepted in the current estimates.

There are six third-class cruisers protected, all completed, and all sisters. First come the Coetlogon, Cosmao, Forbin, and Surcouf. The last was at Portsmouth. They are 1850 tons displacement, 312 feet long, 30 feet beam; speed 19·5 knots; 2400 knots coal endurance. There is a protective deck throughout, flat at the middle, sloped at the sides, 1·57 inches thick. There is a coffer dam on armoured deck all round the sides, three feet three inches high, two feet six inches wide, filled with cellulose, this is to prevent a rush of water when the side is pierced. The armament consists of four 14^{cm} guns in the Coetlogon, two similar guns in the other three vessels in sponsons abreast the foremost funnel. The Coetlogon has four of these sponsons by the way. These guns will cross their fire a very short distance ahead and astern. They are rigged as three-masted schooners and have no fighting tops. There are two funnels oblong and very high, both nearer the mainmast than to the other masts. The sponsons of this class are very rectangular in appearance, and open to let the gun be fired like the upper part of a horse-box.

The remaining two vessels, the Tronde and the Lalande, are similar in every way though they are a foot shorter and 27 tons more displacement, but their funnels are between the fore and mainmasts. There is a peculiarity in all these funnels, namely, that they are of unequal size. The smaller or thinner one being the after funnel in the four first ships, and the foremost in the last two. I append a list of these protected cruisers :—

PROTECTED CRUISERS.—FIRST CLASS.

Sfax, Tage, Cecille, Jean Bart, Isly,* and Alger.*

SECOND CLASS.

Davout, Suchet,* Bugeaud,† Friant, and Chasseloup-Laubat.†

THIRD CLASS.

Forbin, Cosmao, Surcouf, Coetlogon, Lalande, and Troude.

* Not yet launched. † Tenders even not yet accepted.

Third Part.—RUSSIAN.

In the year 1861 the first order affecting the Russian iron-clad fleet was given, namely, the Sevastopol and the Petropaulski, which were then being built, were to be armoured with 4·5-inch iron plates. The first of these was launched at Cronstadt on August 24th, 1864, and thus became the father of the Russian armoured fleet. These two vessels were very similar to our Warrior and Black Prince, exceeding in measurement the Gloire and Normandie. After a life of activity they have been heavily armed respectively with 10 and 21 8-inch 9-ton B.L.R. guns for harbour service. These vessels were followed in the year 1865 by the launch of the Pervenetz, Netron-Menya, and Kreml. The first of these is an iron vessel of only 3279 tons displacement, the second nearly 4000, and the third of 3412 tons displacement. They are now armed as follows :—Six 8-inch 9-ton guns, with six 6-inch 4-ton ditto, 12 8-inch, and 12 8-inch with two 6-inch respectively, besides Maxims, etc. They also have been relegated to coast service. Their armour varies from 4·5 inches to six inches in thickness. They are all broadside ships, uniformly covered all over above the water-line with armour.

At the time these ships were building the attention of the Russian naval authorities was being principally directed to vessels for coast defence ; accordingly in 1864 10 single-turreted monitors were launched, designed on Mr. Ericsson's plans. They are the Bronenosetz, Edinorog, Koldun, Latnik, Lava, Strelitz, Tifun, Uragan, Perun, and Veschun. Nothing can be much simpler than these boats. A single revolving turret, with a pair of guns in the very centre of an armoured deck, almost on the level with the water. The freeboard, in fact, is only 18 inches. Abaft the turret is the funnel. The hull has five inches of armour, with 39 inches of backing, the bow nine inches ; while eight inches of iron is round the lower part of the funnel, 10 inches round the turret, and round its base a ring 15 inches high and five inches thick. The armour at the ship's sides ran down three feet six inches below the water-line. They are now armed with two 9-inch 15-ton B.L.R. guns. Their displacement is 1500 tons, length 200 feet, beam 46 feet. They are very similar to the American monitor. It appears that Mr. Ericsson submitted this design to Napoleon III. in September, 1854, and Admiral Hamilton remarks that had it been to the Czar our fleets in the Baltic and Black Sea might have come to the same untimely end as the Congress and Cumberland frigates when they met in battle the Merrimac.

Besides these ships a double turret vessel was built for ocean service, the Smertch. She was after Captain Cowper Coles' designs. It is claimed for her that she exhibited fair sea-going qualities, but she has never been used except for coast defence. Her armour was very similar to the other ten boats. She has one 15-ton gun in each turret.

Besides these, two larger monitors were constructed of some 1850 tons displacement, the Rusalka and the Charodeika ; their freeboard

is only two feet. They have each two turrets with a pair of 15-ton guns in each, and a slight superstructure between the turrets. Their armour is only about the same. None of these vessels draw much more than 12 feet of water, an important point when the shallow waters of the Baltic ports are considered. The last two vessels have been said to roll 35°, but, I think, it is certainly open to doubt if they have ever been tested to that extent—at any rate since the loss of the Captain. The same year that they were launched, the four Admirals, Lazareff, Greig, Spiradoff, and Chichagoff were laid down. They were intended to be fully-rigged sea-going turret ships of the low freeboard type, but our disaster in the Bay of Biscay on 6th September, 1870, happening to such a very similar class, caused the idea of equipping them as cruisers to be abandoned, hence we now find them among the coast defence vessels. They are 250 feet long, 42 feet beam, 3500 tons displacement. The armour is 4·5 inches thick throughout, and covers the hull from five feet six inches above the water-line to six feet below. There are three turrets with single guns in the first two ships; one in the centre, the other two at equal distances fore and aft. There is one funnel, with a conning tower between the bow and centre turrets. There are three masts with a light yard on the foremast. The other two have but double turrets for single guns; a funnel and mast between the turrets, and a fore and mizen mast in front and abaft them. These guns are 11-inch 28-ton B.L.R. guns. Their speed is 10 knots. The height of the deck above the water-line is only from four feet to six feet. The turret armour of the two last ships is six inches thick. There is a superstructure erected between them. Had these four ships been built later they would probably have been styled barbettes, as the turrets are open at the top and the guns revolve on a platform and fire over them.

The ships hitherto mentioned are for the defence of the Baltic or the Black Sea, it was thought that a draft of 14 feet should not be exceeded, the Admirals drawing 20 feet against the 12 feet of the preceding vessels. At the same time something much more ambitious than armoured gunboats were needed. Now, Sir Edward Reed had been steadily increasing the proportion of beam to length in our English ships, accordingly the Russians determined to go at once to the maximum, and reached its culminating point by building two circular vessels, the Novgorod and the Vice-Admiral Popoff. These curious craft have a displacement of 2700 and 3500 tons respectively, with a diameter in the one case of 101 feet and in the other 120 feet. They stand only 18 inches out of the water, and have from nine inches to seven inches of armour round their sides, with an armoured deck slightly curved of nearly three inches thick. In the centre is an open turret rising seven feet above the deck, with nine inches of armour round it.

The armament is a pair of two 11-inch 29-ton guns in the first ship, and two 12-inch 40-ton guns in the latter. They have each a signal mast and two funnels. The line passing through the centre of these is much nearer the centre of the circle in the bigger boat, *i.e.*, a longer

chord. They can only steam about six knots. Naturally, perhaps, Sir Edward Reed has highly commended them; that no more have been built in the last 18 years is proof enough of their true value. They seem to be almost better in the open sea than at the mouths of tidal rivers. They once attempted to ascend the Sulina, at first all went well against the stream, till anchor was raised to return. Before weigh could be got on they commenced to spin round, and no efforts were sufficient to regain the mastery over the current till well out to sea. The system of barbettes adopted first by the French and followed by ourselves affords a wide lateral range and a plunging fire, though at the disadvantage of leaving the crews fully exposed. In this instance only the latter disadvantage was obtained, hence the Popoff has her guns on disappearing carriages on Rendel's system.

Three vessels have to be added to this fleet of coast defenders. One, the Kniaz Pojarski, followed the five early armoured cruisers in 1867. She is the only central battery ship the Russians have. She is 272 feet long, 50 feet beam, and over 5000 tons displacement. Her armour is only 4·5 inches thick, and her speed 12 knots. The central battery occupies about 80 feet of her length. There are eight 9-ton guns, four firing as broadside pieces, four through indented ports as in our Penelope. There are also two 6-inch 4-ton guns as bow and stern chasers. She is rigged as a ship, and has one funnel between main and foremast. Her battery should distinguish her. She is now relegated to coast service, but having new machinery would, of course, be used if necessary elsewhere.

The other two vessels are two small river gunboats captured from the Turks in 1877, named the Nikopol and the Sistova. They are beneath our attention.

I append a list of the fleet we have considered :—

RUSSIAN COAST SERVICE ARMOURED FLEET.—BALTIC.

1st Group.—Sevastopol, Petropaulski, Pervenetz, Netron-Meyna, and Kreml.
2nd Group.—Kniaz Pojarski.

TURRET-SHIPS.

1st Group.—Bronosetz, Edinorog, Koldun, Latnik, Lava, Strelitz, Tifun, Uragan, Perun, and Veshtchun.
2nd Group.—Smertch, Rusalka, and Charodeika.
3rd Group.—Admiral Lazareff, Admiral Greig, Admiral Chichagoff, and Admiral Spiradoff.

BLACK SEA.

Novgorod and Vice-Admiral Popoff.

GUNBOATS.

Nikopol and Sistova.

The Table given by Captain Nash of Russian ships has suffered somewhat at the hands of the Printer,[1] and is, I really think, somewhat misleading.

[1] I am not here alluding to the letter T before two vessels' names.

Thus he places in his first batch of 6-inch armour, three of the later monitors, an Admiral, and the old line-of-battleship Kreml. Now, the three monitors only have that amount of armour, according to our Naval Intelligence Department, just in front of their turrets. In rear of them, and everywhere on the ship itself, they have but 4·5 inches of armour. Hence the 6-inch B.L. and 9-inch M.L. should be able to sink them a long way over 4000 yards.

Again, the Admiral has six inches everywhere, as, indeed, the Spiradoff also, which he places in the higher class, though it is only the turrets which have seven inches, I know the head line covers it, but that does not make it less misleading. The Novgorod is here placed right owing to her uniformity of armour, but the 10 small monitors, are far easier vessels to fight, which one would not anticipate from their being given 10 inches of armour. In other words, instead of a Table showing the armour in front of the main armament, would it not be better to insert one giving the thickness of armour protection given to the ship itself, for if one sinks the ship the main armament will go to the bottom.

RUSSIAN LINE-OF-BATTLESHIPS.

We now come to the first of these, the Peter the Great. This was built to compete with our Devastation, and was begun soon after she was commenced. Her length is 328 feet, beam 62 feet, and displacement 8700 tons. Being designed to master our turret-ship, she more resembles our Dreadnought, which is an improved Thunderer. Her belt is from 14 inches thick amidships to eight inches aft, and is five feet below the water to a varying height of from one foot forward and two feet aft to 10 feet amidships. This is due to the breastwork or redoubt, which covers about half her length and all her breadth, as in the Dreadnought. The armour of this and of the two turrets which are placed in line with the keel is 14 inches. The armoured deck over the breastwork is 1·5 inches thick, over the ends three inches. For armament she has a pair of 12-inch 40-ton B.L.R. guns in each turret, and seven Q.F., mostly on upper deck.

Her endurance is 1300 knots. In general appearance she is very like our three ships that I have named, but her superstructure is shorter and she has but one funnel. I believe she was not a success, as she shakes so much as to engender weakness if driven over eight knots, while she is terribly wet and leaks. She has no ram.

Three ships of an improved type followed, the Tchesmé, Catherine II., and the Sinopé. They are all three in the Black Sea fleet; length 331 feet, beam 69 feet, displacement over 10,000 tons. Speed 16 knots, with a coal endurance of 1350 at 14-knot speed.

The belt varies in thickness from eight inches at the bow and stern to 16 inches amidships. It extends from three feet above the water-line to five feet below, running down to the ram. On this is an armoured deck 1·5 inches of steel, except before and abaft the citadel, where it is 2·5 inches thick. On this is erected a rectangular citadel nine inches and 10 inches thick at bulkheads, and 12 inches at the sides. On this again comes a 12-inch pear-shaped redoubt, the point

being to the stern. Here are three barbettes, one at the stern and two in line at the bow end. The rest of the ship is then built up with unarmoured ends, not, indeed, quite flush with the top of these barbettes, but within 18 inches of it. In the centre, between the pair of barbettes at the bow end and the single barbette at the stern, is a superstructure similar to Peter the Great. In each barbette are two 12-inch 50-ton B.L.R. guns. Thus she can fire four guns right ahead and two astern. There is a secondary armament of seven 6-inch guns which are on the main deck outside the citadel; they fire out of recessed ports, four in the bow, two in the stern, one uncertain. The Sinope has her secondary armament in sponsons instead.

They have each two large funnels fore and aft amidships, and a single military mast with one fighting top, except the Sinope, which has two.

They stand well out the water, the fore barbettes projecting over the sides. The barbette guns of the Tchesma and the Catherine II. are not seen, being on disappearing carriages. Those of the Sinope are visible. The Twelve Apostles—Dvenadsat Apostoloff—was launched in 1890, but is not yet completed. She is 320 feet long, 60 feet beam, 8000 tons displacement. Like our modern ships, and unlike any of the French, her belt will only extend over 220 feet of her length, 1·5 feet above the water, five feet below, 14 inches thick abreast of the engines and boilers, 12 inches thick before and abaft them. The protective deck over the unarmoured ends is 2·5 inches thick, elsewhere two inches. Above the belt and eight feet shorter is a citadel six feet high, armour 12 inches. Above this again the battery, which is eight feet nine inches high, armour six inches thick. She has two turrets; the armament does not appear to be yet finally fixed.

There are two other first-class line-of-battleships building, the Gheorghy Pobyedonosets, of 10,000 tons, and the Hango-Udd, but little is known of them.

It is devoutly to be wished that some authority could lay down certain definitions as to what constitutes a line-of-battleship, first and second-class, an armoured cruiser, etc.

Whether the following vessels should be shown as second-class battleships or cruisers seems most uncertain.

The Russians have always shown themselves most active in this form of vessel, as Lord Brassey points out, horizontal armour for such craft they will not look at—the belted cruiser of large size and heavily armed is their beau ideal.

The first of this class is the Minim. She was constructed as a rigged turret-ship, but owing to the loss of the Captain she was altered completely. She is 289 feet long, 49 feet beam, and 5800 tons displacement. She has a belt seven feet high, seven inches and six inches thick, with a metal deck on the belt one inch thick. On the upper deck are eight 6-inch as broadside guns, and four 6-inch 9-ton gun in sponsons, while there are four more 6-inch guns in embrasure ports on bows and quarters, besides 12 Q.Fs. She is

heavily rigged as a barque with double topsail yards, and has one funnel in line with the after end of the fore sponsons. She can steam 13 knots.

We have now to consider the General-Admiral and the Duke of Edinburgh. They were designed to compete with our Raleigh and Boadicea, and were launched in 1873 and 1875. Length 285 feet, beam 50 feet, displacement 4600 tons. The belt is seven feet high with a thickness of six inches and five inches, with a horizontal steel deck over it of one inch thick. They are usually described as central battery ships, but are not so in reality. What is mistaken for such is an iron coaming 4·5 feet high on the main deck which runs round the engine-room hatch to protect them, as the engines are vertical. This coaming has six inches of iron with seven inches of backing. The first ship has six 8-inch guns on upper deck in proximity to the funnel, and two six inch chase, one under forecastle one under poop. The Duke has four 8-inch guns at the corners of the battery on the upper deck, five 6-inch, two on broadside between the 8-inch, two under forecastle, and one under poop.

In both ships, when the bulwarks are let down, the crews serving the guns on broadside are completely exposed. They can steam 12 knots. The funnel is in the centre of ship. They are fully rigged, and have a large topgallant forecastle which is built up and extends nearly as far aft as the funnel. There is a low bridge before mainmast. A large poop which is cut away to allow of stern fire. The battery which is abreast of the funnel projects from the sides.

The next pair of cruisers are the Vladimir Monomakh and the Dimitri Donskoi. They are fairly similar, but differ a little.

The first is 296 feet long, 52 feet beam, 5800 tons displacement. She has steamed over 15 knots. She has a compound armoured belt from six inches to 4·5 inches thick, two feet six inches above the water-line and five feet six inches below. Her stern plating is weak and badly put together, and it is said would be likely to go to pieces if hit hardly. Her steel deck is from two inches to three inches thick. Her armament consists of four 8-inch 9-tons guns in half round sponsons on the main deck; and twelve 6-inch 4-ton guns, of which eight are between the sponsons, two fore and two aft in recessed ports, so that they can fire with the line of keel. She is very heavily rigged as a ship, with lofty topgallant masts and studding sails. She has two funnels; the after one very near the centre. These two funnels serve to divide the space between the foremast and mainmast fairly equally, but the after one is nearer the mast.

The Dimitri Donskoi is very similar, only she has 14 6-inch guns on main deck, of which four are in angle ports for fore and aft fire. She has two 8-inch guns in sponsons just abaft the foremost funnel on turn-tables. These are well marked. She is very similar to the sister ship, but has two bridges, one before the funnels like the Vladimir, the other before the mizen; also a stern gallery.

The Admiral Nakhimoff, not to be confused with the Admiral class, is a copy of our Imperieuse. She is nearly 8000 tons displacement,

330 feet long, 61 beam. For the first time the belt no longer runs round the ship, but is only 147 feet long, with armoured bulkheads forming a rectangle extending three feet above the water-line to five feet below, and from 10 inches to six inches thick. She has eight 8-inch 13·7-ton guns in pairs in barbettes on the spar deck. One forward, one aft, and one each side just abaft the funnel. These towers are protected with eight inches of iron, which extends down to the battery deck. Here are 10 6-inch 6·3-ton guns, the foremost and after guns firing ahead and astern respectively, the remainder on the broadside. She is rigged as a brig, and has one large oval funnel between masts. There is a slight superstructure round it which extends some little way aft. Is represented as not a good sea-going boat. All these three last vessels have been employed in the China seas.

The Alexander II. and the Nicolas I. are termed by the Russians line-of-battleships, though Lord Brassey counts them as cruisers. They certainly largely resemble the last vessel; 8400 tons displacement, 326 feet long, 67 beam. The belt, however, is continuous, from 14 inches to six inches, while one would have fancied that no cruiser would have needed their armament, viz., two 12-inch 50·5-ton guns mounted in a bow barbette, of 12 inches of armour, with a circular cover of three inches. It extends down to the armoured deck, which is three inches thick. On the main deck are four 9-inch guns and four 6-inch, all in the main battery, which is protected by armoured bulkheads, that in the bow joining the tower and the sides. The larger guns here are in embrasure ports training from line of keel to the beam. Outside this battery are four other 6-inch guns also in embrasure ports, two at the stern, two at the bow. These vessels can, therefore, bring a very strong bow fire to bear, namely, two 12-inch from the barbette, two 9-inch from the main battery, and two 6-inch from the forward bow chasers.

As regards appearance the Alexander has two military steel masts, with single fighting tops on each, two round upright funnels, the after one in the centre of the ship, a conning tower just before foremast, and a prominent deck-house in her stern. The Nicolas is similar, but has a poop and two stern walks. Their speed is said to be 15·5 knots. The barbette tower is very prominent.

The Pamyat Azova—the Remembrance of Azoff—is a true cruiser; 6000 tons, 378 feet long, 50 feet beam. She can steam 18 knots, with a coal endurance of 12,000 knots at 10-knot speed. Her belt, six inches to four inches, extends nearly her whole length with bulkheads at its extremities. She has two 8-inch 13·7-ton guns in semi-circular sponsons between the two foremost funnels. These have a training of nearly 180°; 12 6-inch, four in angle ports, bow and stern, eight as broadside guns—all secondary armour on the main deck.

She is rigged as a barque and has three funnels, all between fore and mainmasts. The upper deck is flush except for a short forecastle. The upper part of the stem is straight, the lower part ram-shaped. She has a stern gallery running far round the quarter.

There are three other armoured cruisers being built. The first, the Gangoot, is evidently of secondary importance, 278 feet long, 62 feet beam, and 6600 tons displacement. She has been launched, but, I think, not completed. I can learn little about her. She is only estimated to go 14·5 knots an hour, and is to have six 9-inch and six 6-inch guns.

The Navarin is a splendid vessel, 338 feet long, 67 feet beam, 9457 tons displacement; to steam 16 knots, and to carry four 12-inch 50-ton guns, with eight 6-inch. Even finer is the Rurik, nearly 11,000 tons displacement, 396 feet long, and 67 feet beam, 18 knots an hour, with four 8-inch 13·5-ton guns and 16 6-inch, with a belt 10 inches thick.

I append a list of the armoured fleet we have been considering :—

RUSSIAN ARMOURED FLEET.—BALTIC.

Peter the Great, Dvenadsat Apostoloff—12 Apostles, Gheorghy Pobyedonoset, and Hango-Udd.

Armoured Cruisers.

Minim, General-Admiral, Gergoz Edinburgski, Vladimir Monomakh, Dimitr Donskoi, Admiral Nachimoff, Emperor Alexander II., Emperor Nicolas I., Pamyat Azova, Gangoot, Navarin, and Rurik.

BLACK SEA.

Tchesma, Catherine II., and Sinope.

I have already mentioned that horizontal armour alone Russia does not trust in. Hence she has only three protected cruisers. The Rynda and the Vitiaz are sister ships; 3000 tons displacement, 265 feet long, 46 feet beam. They can steam but 15 knots, with a coal endurance of 2400 at 10-knot speed. The steel deck is 1·5 inches thick. The armament consists of 10 6-inch 4·1-ton guns, of which four are in sponsons and train fore and aft, the remainder on the broadsides between the sponsons. They are rigged as a barque, and have two funnels between fore and mainmasts. There is a clipper bow and topgallant forecastle.

A different kind of vessel is the Admiral Korniloff, 5000 tons displacement, 350 feet long, and 49 feet beam, steaming 19 knots; here the deck for protection is 2·5 inches thick.

She has 14 6-inch guns on broadside on the upper deck, the embrasure being 16·25 feet wide; the foremost and after guns are in sponsons which do not project much. She is lightly rigged as a barque—no royal yards—and has two protected tops. Two funnels, fore and aft.

This completes the Russian fleet, with the exception of three armoured gunboats, the Grozyashtchy, Ofrain, and the Gremgastchy. They are 220 feet long, 40 feet beam, 1500 tons displacement. The last two are still building. They each carry one 9-inch 19-ton gun

and one 6-inch ditto, the former in a barbette in the bow. They have two poles for masts and one round funnel. The big gun is not very prominent, owing to a spar deck which hangs partly over it.

GIBRALTAR,
October, 1891.

ERRATA.

The following corrections are necessary in part I. of this series, which appeared in No. I., Vol. XIX., R.A.I. "Proceedings":—

Page 20, lines 14 and 15, *for* "inches" *read* "feet."

Page 20, last line, *for* "40 inches" *read* "40 feet."

Page 23, line 4, *for* "have" *read* "has."

Page 24, line 8, *for* "Aft" *read* "Abaft."

Page 26, para. 6, line 4, *for* "entends" *read* "extends."

Page 26, para. 7, line 7, *after* "10-inch" *insert* "M.L.R."

The series closes prematurely with this paper, the preparation of which must have been one of the last tasks of Major Robertson's life.

In addition to the great general sorrow for his death, it must be a matter of deep regret that the Royal Artillery will never learn the opinions and deductions promised in the last paragraph but one of Part I, on page 30.

NAVAL ATTACK OF FORTIFICATIONS.

BY

CAPTAIN H. J. MAY, R.N.

(Lecture delivered at the School of Gunnery, Shoeburyness).

PART II.

Gentlemen, I spoke last week of what I considered were the general conditions of naval warfare, and of the operation which I thought most feasible and most likely in connection with forts—that is to say, running past the forts, either by big ships or by boats. I will now come to another matter which has been much feared by some people abroad, and that is bombardment.

It is apparently considered abroad that places which are open to bombardment by ships are in very much more danger now than they were in the old wars. I confess that I cannot quite see it in the same light. The first question is: What is it that is in danger from bombardment? The only answer that I know of is, ships. The only things that it is worth while for ships to attack are other ships, and perhaps we may add to that, the stores essential to ships. Now, we have perhaps a dockyard (or an arsenal, as they generally call it abroad) which contains ships re-fitting, and their stores which are stowed on shore, and we oppose to that sea-going ships afloat, fit for sea in every respect. If you damage a ship which is in the dockyard on shore she is very easily repaired. Of course you cannot sink her, because she is practically on shore already; and you will not prevent her going to sea, because she is not fit for sea, or she would not be in the dockyard. Again, as to the stores: it is a fact that certain stores which are pretty easily injured are stowed now, in some instances, fairly close to waters which might be occupied by hostile ships; but it is not necessary that they should be so stowed. It is easy to move those stores if you think it advisable, or you might put the stores (as they do not now) in bomb-proof casemates. All this appears to me to be evidence of the fact that bombardment is not really very greatly feared, at least by the people who have charge of the stores, or they would take more care of them. On the other hand, abroad especially, they are putting up in all directions anti-bombardment batteries; and in one particular case, at any rate—that is Cronstadt—I believe they are spending mints of money in obstructing the waters by miles and miles of piles and breakwaters and things of that kind, so that you cannot get anywhere near bombarding distance at all, unless you go up a channel about the size of the Suez Canal.

As to history upon this point, I do not think it tells us very much; at any rate, it is pretty negative. I do not think anyone can say that this or that great war was affected much because successful bombardment took place; neither, I think, can one say that this or that Power was unable to put such a large fleet at sea because its arsenals were bombarded and the work was retarded. I do not think anything of the kind has happened; and when bombardment has taken place, it has often been, because there was nothing much better to do.

A very good instance is Sveaborg in the Baltic. We had obtained complete ascendancy at sea, and the British fleet had nothing to do; the Russian batteries covered some stores and magazines and a few ships: of course the fleet were most anxious to go and do something, and the something was decided to be an attack upon Sveaborg. Well, there was lots of time; there was no particular object in attacking Sveaborg at that moment rather than in attacking it a month later, because nothing that would hurt us was likely to issue from Sveaborg within the month; so there being lots of time, they built special craft for the purpose. That shows that we did not care, even in that extreme case, to risk our valuable sea-going ships in knocking down those magazines and things at Sveaborg; but we built special gunboats, and supplied them with a lot of shell, and they went in and bombarded the place. There was an immense deal of firing for two or three days: we said we had done a great deal of harm, and the Russians said we had not. There was certainly nothing done that proved to be of advantage in the general conduct of the war, and the result does not appear to me to encourage a similar course of action in the future.

Again, in the war of the American rebellion Charlestown was shelled, but it did not affect the defence of Charlestown one whit. It annoyed the people, and frightened some of them, but Charlestown did not fall in the least any quicker because it was shelled. The Federals complained rather in the case of Vicksburg, which they had attacked specially with mortar-boats, that although for the time everybody was shelled out of the river front, they came back again, and refused to be shelled out permanently; and so I think it would be generally—bombardment would have no permanent effect.

However, supposing we had to bombard a place, supposing it were found that something was to be gained by it, the principle would be to risk a little and do as much indiscriminate damage as you could; and very indiscriminate it would be, I am afraid. On the one hand, you have the sea-going ship some thousands of yards out in the open. If there are any batteries to defend the place you want to bombard, the batteries can see the ship quite plainly, and they have every assistance in the way of range-finders to improve their fire; whereas you, remember, are not attacking a dockyard, but a ship in the dockyard, or the stores in the dockyard. If you throw shell haphazard into the dockyard, I dare say four shells out of five will not hit anything except gravel walks, or stones, or an empty dock or basin, and that will not do much harm. The only shell that will do harm will be those that fall into the stores, where there is something that can be broken up easily, or those that actually hit a ship. When we consider that the

batteries are very often some three or four or five or six thousands yards in advance of the dockyard, the game hardly appears to me to be worth the candle. The chances are just as great, I imagine, of the batteries pitching a shell into your sea-going ship as of the sea-going ship pitching a shell into the dockyard; and when they have pitched a shell into your sea-going ship they have done much more damage than you have done by the shell you have pitched on to the shore.

As to the question whether we should employ special craft, I think we might, as was done in the case of Sveaborg, run up special mortar-boats or small craft capable of carrying one or two sizeable guns. Any gun will do—breech-loader or muzzle-loader—it does not much matter. If we used craft of this kind we should not mind if we lost them, and we should not mind running them into shoal-water and into places where we should not venture with our big ships, so that that might make us rather more daring. But as to the big ships, they would keep under way, so as to avoid being hit; but again, if the people on shore have range-finders, being under way ought not to make much difference, and if you found you were getting much hit you would go away, so that remaining under way would make you all ready for that proceeding.

As to the question whether high explosive shells would make much difference, perhaps you could tell me more than I can tell you; but as far as I have gone I do not think they would, and at present we do not see our way to admitting high explosive shells as part of the equipment of a ship. The risk of their going off in our guns outweighs any possible advantage that we know of at present. High explosive shells might, however, be used in a special flotilla, just as the special flotilla of the old days fired shells and bombs, which the ship's guns did not.

There are some places, but only a few, where the defence on shore has not been well arranged, where it would be possible to push in some of those special craft where there is nothing on shore to oppose them; but if the defence were active, as it should be, a very few field guns brought there would send these small craft away; after all the most unassailable position for a ship is for her to get behind some small island which her men can occupy. There was an instance of that in the case of the war between Chili and Peru. The Peruvians left an island off Callao unoccupied, and the Chilian ships got behind this island, and threw shell at the only Peruvian ship that was in the dock. They threw shell at this ship off and on, I think, for many months, and at the end of those many months she was just as intact as she was at the beginning; and the only thing that brought matters to an issue with regard to that ship was the taking of the town by a land force, when the ship was burnt at once lest she should fall into the Chilians' hands.

I do not think that in case of a bombardment it is necessary much to consider the forts. We should be so far off the forts that it would not be possible to subdue their fire to any material extent, and shell fired at the forts would be practically thrown away. If the forts were annoying us to an extent which became serious, instead of trying to

keep their fire under by firing back, I think we should simply go off. Still it is, of course, just possible that the artillery defence might be so feeble that we could silence it ; in that case we should undoubtedly go in quite close, as I shall tell you presently, and deliberately attack the place, but if we could not do that we should leave the forts alone.

Now I come to the direct attack on a fort. As you may suppose, I do not think it is a thing that is likely to happen ; but still forts are not always as strong as they ideally ought to be, nor are the men always as good as they ought to be, and there may be cases in which it may be worth while to go in and attack a fort. The main question in that, as in all military operations, of course is : Is it worth your while ?

Perhaps in the old days this was not so much considered. In olden times, when knights rode about on gallant steeds, when a knight saw a castle he said, "Let us attack it;" or when a ship saw anything in the way of a castle on the shore, the ship went in at it ; but I do not think they ever considered much whether this would tend towards attaining the object of the war. But that is not the case now-a-days. Nothing is now done unless we hope by our strategy and our tactics to win what we are fighting for. We do not fight for little things, but for large things.

Again, there is no exception, so far as I know, to the general rule of war, that the weakest point of the defence should be picked out ; and the first consideration is, whether the weakest point is afloat or on shore. Nearly all the experience of the past goes to show that the weakest point is generally on shore. That is to say, that a landing party can do in most cases better than ships. I believe the cases where strong places have fallen to an attack by ships can be counted upon your fingers : they do not number one to ten of the cases in which, when it was decided that the attack should be made, it was found that the weakest point was on shore, and people were landed to attack that weak point.

I need not say that there must be a sufficient force, not only to carry out your attack, but to meet any counter attack which may come either from the place itself, or from ports in its neighbourhood.

There remains the great advantage that ships always must have over land forces, and that is their very great mobility and, therefore, their power of surprise. Suddenness of assault will be the great point in any attack of this kind which is likely to be successful.

One of the more notable instances of ships succeeding without any help from the shore was Portobello ; but that was a case of surprise and sudden assault. Very soon after the outbreak of war we sent a fleet to the West Indies, and that fleet swooped down upon Portobello. Portobello was very much unprepared ; and I believe that as soon as the garrison saw the English ships in the offing they made up their minds that they were going to be beaten ; and it is further said that some of them coming to the conclusion that the town would certainly be sacked, thought they had better do the sacking themselves, rather than let the English do it for them, and that accordingly a considerable number of the garrison were standing by to sack the town when

the attack took place, and that when it did take place they all ran away from the outlying forts, and sacked the town themselves. But I do not think we can expect that to happen again.

Again, in the American War, Port Royal had been hastily fortified by the Southerners, because they thought the Northerners might require it as a base for their ships—as indeed they did. The landing party, which was to have been the main attacking force, was not quite ready. The ships went in, and they found the batteries poorly constructed, with no traverses, and they overwhelmed those batteries with heavy fire. The men in the batteries thought, I suppose, that it was not of much use hanging on, and so they evacuated the place. But even there it appears to me that if they had waited till nightfall, and set to work to remount their guns, there might have been a good deal more fight left.

Again, supposing that an attack is to be made from the sea, there comes in another general principle of war, that you must concentrate your attacking force, and you must overwhelm in detail; and remember that your objective is to silence the works by driving the gunners from their guns, and then disabling or dismounting the guns. You have nothing to do with breaching or knocking down structures; you have to get rid of the guns, because it is only the guns that will hurt you. For this you want superiority of fire. Superiority of fire means not more firing, but more hits on the target, which hits are to decide the action. And directly we come to consider this, we see that the size of the target presented by a well-designed battery is very small indeed. Perhaps two feet high is about all you can injure if it is an ordinary earthen battery; and where expense has been gone to in the matter of plating, and the plating is very thick the target is very much smaller. But, of course, anything in the way of iron-plating must be very difficult to fit up on shore without some masonry work to put it into; and then if you come to a masonry fort I allow the target is very large; but I do not suppose that anybody would ever build a masonry fort again. We have, unfortunately, got a fair number of them, but even those can be improved. But generally there are but very few exceptions to the general rule that the target on shore is very small.

Now the target presented by a ship, as I pointed out in my last lecture, is very large. To begin with, there is an immense deal in a ship that has very little to do with her guns, but which is an essential part of the ship, as helping to keep her afloat, and which is quite unarmoured. Then again, we have to leave more than four-fifths of our guns entirely unarmoured; in fact, worse than unarmoured; because if you look at this section which hangs behind me, you will see what a box of machinery a ship is now-a-days. A shell comes in, and not only splinters from the shell itself, but splinters from all these things, go to sweep the deck and make an unarmoured ship utterly untenable under a heavy fire. There are only, as I pointed out in the last lecture, in the ordinary modern fighting ship something like four guns which are armoured at all; and even those present quite as large a target as an ordinary barbette gun on shore; and perhaps larger,

because you must remember that a shell coming under here (*pointing to the section*) may very likely upset the loading gear, and in many cases the loading gear could be upset by a shell which would not pierce the armour of the turret or barbette.

On the other hand, on shore there is nothing vulnerable except the gun; there is no earthly reason why you should put anything else under fire, you can keep your men well down under the parapet, and it is only the gun that can be hit. So that to get a moderate number of hits from the ship we want a great number of guns. In the old days I believe it was considered that the odds which would justify a ship in attacking a battery with any chance of success were something like three or four to one in number of guns. That has been varied a good deal, but I think on the whole we may consider that nothing less than that would do at all. In the cases where the ships have had fewer guns we can explain their success in other ways. In the case of Fort Henry, which was attacked by the Northern gunboats on the Mississippi, the guns afloat were only about three to two of the guns on shore. They were more powerful with regard to weight of projectiles in the proportion of about two to one. But the guns afloat were all very well protected, and none of the guns on shore could pierce the armour which protected the guns afloat. On the other hand, the guns ashore were apparently not so well protected even as they might have been by earth; they were not well traversed; the carriages were low, and the parapets, therefore, were very low. Altogether the shore batteries were not good specimens. It is interesting to note that only a few days later the same gunboats attacked somewhat similar batteries at Fort Donaldson. A great deal is made in some of the accounts of the fact that the batteries at Fort Donaldson were elevated above the river, but this elevation only turns out to have been 32 feet, and 32 feet does not really make all that difference. I think the real difference was that they had had their experience at Fort Henry, and they turned that experience to good account in strengthening the parapets, and therefore they beat off the gunboats at Fort Donaldson.

At Alexandria at one time there was not much difference between the number of guns ashore in the outer works and the number of guns afloat. The outer works had about 21 heavy guns bearing, whereas the three ships, the "Superb," the "Alexandra," and the "Sultan," had 20 guns on the engaged side. And so long as those three ships attacked all the 21 guns indiscriminately, by steaming up and down, there was not much disparity. If the shore guns had only shot a little straighter, I do not know that the ships would have got very much the best of it. The gunners on shore were miserably bad, and their firing was very bad; but as soon as we came to the conclusion that that was a very bad way to attack those forts, and confined an attack to the batteries at one end of the line leaving the other batteries out of action, then we had only about 10 guns at most opposed to our 20, we made head at once, and we were scarcely hit again after that, because the people on shore who shot crooked at first, as they got more frightened shot more crooked still, and finally stopped firing altogether.

As I said before, I think it is absolutely necessary to get close to, because we cannot hit if we are a long way off. At Alexandria certainly we were a long way off, but then, as a matter of fact, we never really hit them. In the report which was made upon the condition of the defences afterwards, it was stated that if the garrison had been Europeans, or at any rate if they had had pluck, on the following morning all the guns except three would have been ready for action. So that the batteries were not really disabled, although the men were demoralised.

Now comes the question : How close should we get ? The limit appears to me to depend very much upon hydrographical considerations—the exigencies of navigation. Of course you can only stow a certain number of ships in a limited piece of water, and the closer you get probably the less room there is for your ships. Therefore supposing that in attacking a certain battery or group of batteries you could but put, we will say, four ships at 800 yards, eight or ten ships at 1200 yards, it might be worth while to go off to 1200 yards so as to get more guns to bear. I do not myself attach any weight to your going a long way off in order that your armour may not be pierced. If a ship gets hit all about the place you will probably disconcert her so much, even without piercing her armour, that she will be glad enough to draw off. In the abortive Northern attack upon Charlestown they had seven very invulnerable ships, monitors. They went into attack the batteries in what appeared to me rather a heedless way, without any particular plan ; they did not anchor. The batteries, on the other hand, appeared to have been very well fought, and to have knocked the ships about very much. The ships were quite invulnerable to most of the shells from the batteries ; but notwithstanding this, and the fact that they only lost something like three or four men in all in the well armoured ships—there was one badly armoured ship that was sunk, notwithstanding that fact they were driven out of action by their guns being disabled because the turrets would not turn, and so on. And you will remember that the American ships were simply, as they were called, " Cheese boxes on a plank ;" they presented a very small target, they were quite unseaworthy, through lack of upper works which were omitted in order that they might be able to stand a heavy fire—and how well they stood fire may be judged by the fact that one of them received 250 hits during the fighting that went on at Charlestown, but was very little damaged. That could never be the case now-a-days. Our ships will not stand so much knocking about as that without feeling it very seriously. The next question is, are we to anchor or not? Yes, decidedly. Anchoring is a necessity if we are to get close to, and another advantage of anchoring is, that the bearing of the object remains constant. We had a lot of trouble at Alexandria from not seeing what to fire at. You picked out a gun that was annoying you, and just as you were laying for that a cloud of smoke came across and you lost sight of it. When the ship was under way, she went on, and when the smoke cleared there was a different view, and you did not know where to look

for the gun. You either fired at the wrong place, or you spent a lot of time in trying to find this gun again.

Again, of course there is no fear of mines if you are at anchor, besides which you can stow your ships very much closer at anchor; if you are under way you must have what we call "sea-room"—room to manœuvre. If you are at anchor you can put two or three times the number of ships into the same space. Another great thing is that you can slew your ship so as to bring the greatest number of guns possible to bear, and you also give an oblique target for the enemy to fire at. In nearly all our ships the guns now-a-days can fire from 30 to 40 degrees from the broadside, and when a ship is slewed in that way the chance of the shot glancing off the armour is considerably greater.

The thing that we should have to fear most in anchoring would be howitzer fire. That, of course, is a comparatively new factor, and it appears to me to be very much to be dreaded. I do not see exactly how you are to cope with that. You cannot see a howitzer. It is behind a wood or no one knows where; and a howitzer shell can get behind your armour, because our ships are not built to cope with that kind of fire. For example, in this ship, of which I have a section here, the top of the turret has only an inch of iron. A comparatively small shell would go right through it, and disable this turret gun, which you would have to get a 13½-inch gun to disable if you use direct fire, but which might be disabled by the fire of a 6-inch howitzer using high angle fire.

Then again, everyone of these guns in the secondary battery is in the same position. They are quite unprotected overhead, the bulkheads across the deck do not help them at all. As to howitzer fire hitting the ship down below, I confess that I am not so much afraid of it as some people are. If howitzers used shell (and I think they would do much better if they did) the shell would burst up here in the upper works, and the pieces would not have a chance against this 3-inch armoured deck. If, on the other hand, howitzers use shot, you have at any rate not nearly so much to fear as you had before. I should not be very much afraid of the shot piercing the armoured deck, because the shot would have to go first of all through a boat perhaps, then through the upper deck and the main deck, and then very often there are coals, stores, provisions, and so on, before it gets to the armoured deck at all; so it is almost certain that the shot would be deflected. And even if it did get through the armoured deck it would very likely land in a coal bunker or store-room; if you hit a boiler, of course, that is a serious thing, but this ship has twelve boilers, and if one is hit you have only one boiler out of action.

Again, engines are not so easy to disable as is sometimes supposed. In the American War there were several cases of shot and shell going amongst their engines, and the ships were not as a rule put entirely out of action. Only the other day in the "Huascar" nearly every one in the engine-room was killed, but the engines were not disabled. It was also exemplified here when that fatal shell exploded which killed Colonel Strangways and so many others. As I

daresay you know, it was close to a 6-inch gun carriage, which has a good deal of machinery. It was so close that the gun carriage saved the lives of several men; but that gun carriage was not put out of action; there were dents and holes made in it, but the gun carriage remains to this day without much or any repair.

Of course, before we began our attack we should want to clear a way, just as we did in running past batteries. There will be the same fight over the mines; the boats must destroy them. But if the boats can do this why should not they do all that is required? The boats can run in and sink the ships alongside the dockyard, and that is probably all you would do if you silenced the forts altogether. There would also be the same necessity for special craft in the way of counter-mining boats, all of which would probably require some base close at hand. A single rough day might wreck all your boats and preparations. The mimic attack which took place at Milford Haven, and which perhaps some of you may remember, was very unpractical in this respect: owing to the weather it was found necessary to make all the preparations for the counter-mining and sweeping within the shelter of the shore, and, therefore, more or less under fire, which would have been scarcely practicable if a real attack had been contemplated.

In the same way the attack would probably have to take place during daylight. The place would have to be cleared of mines and other obstructions during the night; and to make sure that nothing else was laid down you would have to go in as quickly after that as possible.

There would be this further consideration that we had not to take into account when we were going to run past the forts: that we might perhaps back up the boats and counter-mining craft by supporting them with fire from the ships; and, therefore, some artillery fighting might take place at night, but I do not think much. So far as I can see, with all the advantages that electric light confers on the shore forces, ships would never care to come within even moderate range of shore works at night.

We should require to be very definite as to what to fire at. I think that is fairly exemplified by two attacks which took place in the American War, one a success and the other a failure. The first was at Charlestown. The Admiral simply ordered that the ships should go in and fire at Fort Sumter at the middle embrasure. Nobody thought, I suppose, that he wanted every shot to hit the middle embrasure, and not the others, and those orders seem to have been interpreted to mean that so long as they fired at the fort somehow it would be all right. Their ships straggled in, and never got close to at all; they never anchored, and they got the worst of it. On the other hand, when the ships had had a great deal more experience, and they went in towards the end of the war to attack Fort Fisher, led by the "Ironside," which had already been hit 250 times at Charlestown, they knew what forts could do, and what they could not do, and a very elaborate plan was drawn out. Each ship had her station assigned to her, and had orders what gun she was to fire at. The accounts differ somewhat as to the number of guns on shore (but

it was about 40) they had an enormous number of ships, nearly a ship to each gun on shore. At any rate each ship knew exactly where she had to go, and what she had to fire at. The ships came in and took up their stations and at once opened a very heavy fire, and the fort, although it was a very good one in its way, scarcely seemed to make any effective reply. I think part of the reason of that was that the garrison considered that it was not of much use sinking a ship or two, or ten ships, because there were an almost unlimited number of ships in the North, and what the garrison wished to reserve themselves for was the attack by the land force. They beat off the land force on the first assault, and it was only on the second assault that the place fell.

We should, I think, be more afraid of a counter-attack by small craft than of the fire of a fort on shore. We know what we are going to have in the case of the fort, and, as I say, we should not go in unless we had fair reason for supposing that we ought to beat them; but a counter-attack is a thing that you can scarcely sum up. Now-a-days matters are very different from what they used to be. A dinghey with an outrigger torpedo can sink an ironclad. A very small boat can carry a Whitehead, and so on. Very small craft can come and annoy you very much. Of course we should take precautions in the way of nets, but one torpedo will blow the nets away, and a second torpedo might very likely sink a valuable ship. The only way of meeting that, so far as I can see, is ts have a lot of torpedo catchers and boats yourself, which will hunt everything that they can see off the water. That again means rather elaborate preparation; it means a base close to; and it means that at any rate a little more time will be taken for the defence to bring up their counter-attacking force.

As to the projectiles to be used, I have made a note here that the gunners being the main object of attack, shrapnel might come in. Unfortunately I am afraid we have not studied shrapnel fire as we should, and, as you know very well, it is not a very easy thing to carry on an effective fire with shrapnel. Still, if it is worth while attacking a place it might be worth while learning how to fit fuses properly, and to carefully observe the position of the burst, without which there is but little hope of doing much harm with shrapnel. But common shell would be the projectile most used with the idea of silencing the fire of the guns and then of dismounting them. Directly the fire from the guns slackened it would be possible to get closer still, and we should not be content until a gun was dismounted. Of course, if the works were made of stone which you could absolutely knock down with a pennyworth of shot, then it would perhaps be worth while trying to knock the thing down, but this would very seldom happen now-a-days.

Immediately you have silenced a fort you will have to go on and do whatever you intend to do in attacking the place. Set to work to burn and destroy—this is really all you can do. At any rate you can sink any ships that the forts are protecting. If there is a dockyard you can go and blow the dock gates in, and you may burn the dockyard or try to, although it is not so easy to burn a dock-

yard. The Toulon Dockyard was said to be burnt before we evacuated the place in the French Revolutionary War, but when Napoleon came into Toulon it was found that the dockyard was very inefficiently burnt indeed. A very similar case occurred in the American War. The dockyard at New Norfolk, where the "Merrimac" was building, was supposed to be burnt, but it was not really very seriously injured. The fires were lighted, and the place was evacuated, and then the Southern force came in and put the fires out; and I think it is quite possible that you might go in and set fire to a place in a hurry, and go away, and no serious damage might be done.

I will just read to you what Sir Howard Douglass, a great authority in his time on these matters, said; and after all I do not think things change so much that we should disregard his authority. And I was rather flattered to find, what I did not know before, in picking up only a day or two ago a lecture delivered by Captain Bridge in 1873, that he had quoted this very same sentence of Sir Howard Douglass. "However successful a naval attack of a fortress or arsenal may be, the work of destruction can never be effectually accomplished by ships. The sea defences may be silenced, guns dismounted, parapets mined, magazines blown up, and habitations devastated by the cruel process of bombardment; but no substantial demolition of the defences or material destruction of public works and property can be effected unless the damages inflicted by the attacks of ships be followed up and completed by having actual possession of the captured place to ruin it entirely. No naval operation, however skilfully planned and gallantly executed, can alone reap the fruits of its victory." I believe that this was true when Sir Howard Douglass wrote it, and it is true now, that even if all the fire from the shore was suppressed, directly you begin to land to really destroy the place, a very few riflemen, behind ruined buildings if you like, would make matters very uncomfortable, and perhaps you would be glad to get off to your ships again.

If we are going to attack and capture a sea fortress, in nine cases out of ten, and perhaps in 99 cases out of a 100, we must do what you always do on shore—we must assault. You cannot capture a place without assaulting it. Now a ship cannot assault a place, but you can assault it from the shore; and if a place has to surrender, it only surrenders, I take it, because they are afraid of being assaulted.

Of course, we have heaps of historical instances of this, and perhaps we might cite Gibraltar, which in one way was taken by ships, though in another way it was nothing of the kind. The ships brought a sufficient landing force to cope with the Gibraltar garrison. They surprised the place, and put those men on shore, and backed them up by firing as far as they could; but it was the men on shore who assaulted the place, and really decided the business. Another instance occurred only the other day at Valparaiso. It was most necessary for the Parliamentary Chilian party to take Valparaiso. They had a commanding force at sea, and the forts at Valparaiso, I may tell you, were not well armed. They had what we should call regular marine store guns, some of them smooth-bores, and all kinds of things. Did the fleet go in and attack Valparaiso? No, nothing of the kind; and I think

they were quite right. What they did was this, that having cleared the sea of all opposition they shipped a land force and made feints along the coast, which disconcerted the Government party, who did not know where this expedition was going to land in the least, and they finally landed those men on the flank of the place which it was desired to attack. The ships' guns were so far useful that they ensured the safety of the landing, and they helped the land force for some little distance on their way to Valparaiso; but after all the taking of the place was decided by the fighting on shore, and that, I believe, is the best way to attack a place.

What we should have to do in such an instance would be to secure the landing. Now, I take it that a landing does not mean the sort of landing that was effected when our fleet came upon Sebastopol. There an open beach was seized for the purpose of landing, and had it come on to blow (and we know from our experience how it can blow in the Black Sea) when the force was half landed, we should have been in a very difficult position. The place where we want generally to land a force is some place where there is a certain amount of shelter at any rate. There was not much shelter at Balaclava; still there was quite sufficient to allow the ships which were actually landing men or stores to be under shelter, and the ships inside the little harbour of Balaclava could go on landing men almost regardless of the weather. We should want something of that kind unless it was quite certain that the attacking land force was so powerful, and the defence on shore so weak, that the land force could sweep all before them.

There again, I think what we have to fear most is, not batteries on shore. It is impossible to put batteries along the coast for miles and miles from the place that you may wish to assail. What we should be most afraid of, I think, are counter-attacks from comparatively small craft. If the Government vessels the other day, lying under the forts of Valparaiso, had gone out with their torpedoes, and had run amuck amongst the transports of the expedition they might have prevented their landing altogether; they would have been taken and sunk, but still that ought not to have weighed with them. I take it that it did weigh with them, and therefore they did not go; but with a very small force afloat, if you put your heads down you can do a great deal of damage to a force which is landing. It would have been much the same thing if the Russian fleet, instead of scuttling their ships in the harbour of Sebastopol, had come upon our fleet whilst we were engaged in landing those men; and if the Russian land force on shore, had also attacked the people who were landing, I think matters might have gone very differently from the way they did go. But the Russian fleet thought they were inferior, and so they were. I do not think, however, that it is a question of inferiority, or of superiority. Any attack just at the critical moment when you are landing is very difficult to ward off.

Secrecy is the great thing. With secrecy there may not be time to plan a counter-attack until you have got a sufficient force on shore. The first thing, of course, as I need not tell you, when a force gets on shore is to establish some works, so as to make sure that the force shall not be driven into the sea, and the ships will, of course,

push in as close to the shore as possible, so as to make sure in case of a retreat that the re-embarkation will be at any rate supported. But when we have done that we have probably done nearly all we can. There was the case of Sebastopol, of course, where the ships might have helped if the attack had taken the form which, I believe, it was originally meant to take. If the Army when it was landed had attacked the Star Fort on the north side of Sebastopol, that Star Fort was within range of the ships, and the ships in that case would have pushed in, I may say, almost regardless of sacrifices, because in that case it is not so much the ships which you have to care for, but the land force is the main thing; and you must push on and help the land force as best you can, even if you get seriously knocked about in doing so. But I do not think that that is likely to occur again. I do not think that in designing defences people are likely to put the works which a land force would attack so close to the shore that the ships can materially help.

I am afraid I have kept you too long to-day, and I can only say in conclusion that I would wish to impress upon you as much as I can that heavy ships are unlikely to attack forts except for forcing a passage; but on the other hand, that raids on what the forts protect (for that is what the forts are for), namely, ships anchored in protected waters, by torpedo boats or other small craft will be frequent, and will be very annoying, and that is what the shore defences will have to guard against more than anything else.

I will not suggest to-day exactly how you should guard against those raids, but I do not think that it is necessary to have a very strong defence to keep boats off. Old hulks, for example, if moored at the end of a boom, with quick-firing guns on board, would be quite sufficient to sink boats. Of course those hulks would be cleared away by an attack in force, but an attack in force is not the sort of thing that you would expect every day. Then again, subject to geographical conditions, an attack on the land side is most likely to succeed, and is the only method of entirely subduing an active defence.

Finally, a competent defence should be prepared to deliver a counter-attack under all circumstances. A passive defence will sooner or later inevitably be broken down; and a counter attack requires small craft afloat which must be fast and must carry torpedoes. These are the two main characteristics. If they are fast they can ram, and can also use their torpedoes. As for guns in so-called coast defence ships, I think they are much better on shore.

APR 1 1908

ON THE MOTION

OF

ELONGATED PROJECTILES.

BY

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THE latest work on the subject of projectiles from a practical standpoint is that of Rev. F. Bashforth on the "Bashforth Chronograph." In the Chapter devoted to elongated projectiles he gives an explanation of the origin of 'drift' and points out that it will be vertical as well as horizontal: when calculating a trajectory he allows an increase of elevation on account of the vertical drift, but observes (§ 146) that this is not quite satisfactory. The author gives (p. 125) several references to mathematical treatises on the subject, but appears to regard them as of no value for calculation.

The only mathematical work on the subject that I have succeeded in finding is that of Greenhill in the *Minutes of Proceedings of the Royal Artillery Institution*, XI., pp. 124—130. By dint of identifying the axis of the shot with the tangent to the trajectory (p. 126 at the top) and taking one variable ψ to represent the inclination to the horizon of each, his work is greatly simplified, but deprived, as it appears to me, of most of its value: it is the difference between these directions that gives rise to drift, and there is no reason given for the identification but the existence of a couple in the required direction. But since the magnitude of this couple is not proved to be what is required, and since there are considerations of energy, angular momentum about a vertical axis through the origin &c., which he neglects, the reasoning on (p. 126) is not adequate. These objections may be illustrated by the results that Greenhill gets. On p. 127, $\frac{d\psi}{dt}$ is initially finite, in reality it is initially zero if ψ be the angle between the axis of the shot and the horizon.

Hence by the formula on the middle of p. 126, $\frac{dz}{dt}$ is initially finite where z is the coordinate giving the distance from the vertical plane initially containing the tangent: this is obviously untrue, and as a matter of fact, neglecting as Greenhill does any displacement of the centre of gravity from the centre of figure, the fifth differential coefficient with respect to the time is the first that does not vanish.

Again, the angle that Greenhill neglects in identifying the axis and tangent is β' on page 129, and for it he gets an expression

$$\sin 2\beta' = \frac{2c_6 n}{c_1 - c_3} \frac{da}{dt}$$

where

$$\sin 2a' = 8 \frac{n}{\pi} \frac{k_1^2}{k_2^2} \alpha V \frac{g \cos \psi}{v^3},$$

so that β' is initially finite and only vanishes by accident.

The method adopted in the following essay is to obtain six first integrals of the equations of motion of a solid of revolution moving in a perfect liquid under gravity and thence to determine the initial motion. This agrees with the facts of Rev. F. Bashforth's Chapter, p. 128, in that by (xvii.) θ''' is negative, so that the axis rises, by (xviii.) ψ^{IV} is negative, therefore the axis turns to the right and by (xix.) the shot moves to the right. The order of differential coefficients also agrees with the succession of the phenomena, the axis first rising and then turning to the right.

I have not attempted to work out a numerical case, knowing nothing of the practical methods, but a computer might find the values of the velocities of the C. G. at intervals and by substituting in the integrals of the equations of motion, get the values of the $\dot{\theta}$, $\dot{\psi}$, $\dot{y}$ at these times and thence the drift.

1. In the course of the following analysis with regard to the motion under gravity of a solid of revolution through a liquid, it will be assumed that the liquid is perfect and incompressible and that it extends to infinity.

If we take a system of rectangular axes GA, GB, GC fixed in the body, such that G is the centre of gravity and GC the axis of revolution, and if the motion of the body be defined by the instantaneous angular velocities of p, q, r about, and the translational velocities u, v, w of the origin G parallel to, the instantaneous positions of these axes, then Kirchoff has shown (*Gesammelte Abhandlungen*, p. 391) that the kinetic energy of the solid and fluid together may be taken as given by:—

$$\begin{aligned} 2T = {} & P(u^2+v^2) + Rw^2 \\ & + A(p^2+q^2) + Cr^2 \\ & + 2N(uq - vp). \end{aligned}$$

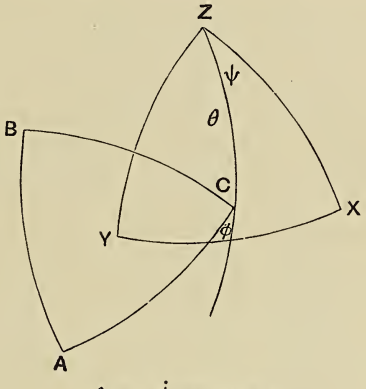
[It may, perhaps, here be remarked that although this expression is correctly given by Kirchoff and Lamb, § 116 (c.), yet Basset, Vol. I.

§ 181, (5) by making use of wrong considerations, gets instead of the above term in N, $2Nw(\omega_1+\omega_2)$: this would obviously be altered on turning the GA, GB axes about GC through an arbitrary angle and is hence impossible.]

If the origin of coordinates be now moved to the point $\left(O, O, \frac{N}{P}\right)$, then $2T$ assumes the form

$$P(u^2+v^2)+Rw^2+A(p^2+q^2)+Cn^2$$

where the letters P, R, C are unaltered and the new A is less than the old A by $\frac{2N^2}{P}$. The form of $2T$ is now the same as for an ellipsoid of revolution and if F be the resultant component of momentum to which the fixed axis OZ is taken parallel and the directions of the axes are given by the ordinary Lagrangian coordinates θ, ψ, ϕ, then Greenhill has shown (*Quarterly Journal*, Vol. XVI., p. 256) that **under no forces** a prolate spheroid has a steady motion given by



$$\theta=a,\ \dot{\psi}=\mu,\ r=n$$

$$x=\frac{F}{\mu}\left(\frac{1}{R}-\frac{1}{P}\right)\sin a\cos a\sin\mu t$$

$$y=\frac{F}{\mu}\left(\frac{1}{R}-\frac{1}{P}\right)\sin a\cos a\cos\mu t$$

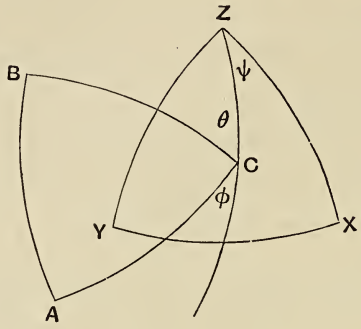
$$z=F\left(\frac{\cos^2 a}{R}+\frac{\sin^2 a}{R}\right)t$$

where

$$A\cos a\,\mu^2-Cn\,\mu+F^2\left(\frac{1}{R}-\frac{1}{P}\right)\cos a=0.$$

2. When gravity is taken into account we refer the motion of the origin fixed in the body to a set of rectangular axes fixed in space of which OZ is drawn vertically upwards and OX, OY such that the initial linear momentum lies in the plane XOZ. We shall have in terms of the Lagrangian cords x, y, z, θ, ϕ, ψ.

$$2T=P[\dot{x}^2+\dot{y}^2+\dot{z}^2]+(R-P)[(\dot{x}\cos\psi+\dot{y}\sin\psi)\sin\theta+\dot{z}\cos\theta]^2$$
$$+A[\dot{\theta}^2+\dot{\psi}^2\sin^2\theta]+C[\dot{\phi}+\dot{\psi}\cos\theta]^2$$



$$U=-Mg\left[z-\frac{N}{P}\cos\theta\right]$$

$\left(\text{for } z-\frac{N}{P}\cos\theta \text{ is the height of the C. G.}\right)$.

The Lagrangian equations of motion are

$$\frac{d}{dt}\left(\frac{\partial T}{\partial\dot{x}}\right)=0,\quad \frac{d}{dt}\left(\frac{\partial T}{\partial\dot{y}}\right)=0,\quad \frac{d}{dt}\left(\frac{\partial T}{\partial\dot{z}}\right)=-Mg$$

$$\left.\begin{aligned}
&\frac{d}{dt}\left(\frac{\partial T}{\partial\dot{\theta}}\right)-\frac{\partial T}{\partial\theta}=-\frac{MNg}{P}\sin\theta, && \text{.....(i)}\\
&\frac{d}{dt}\left(\frac{\partial T}{\partial\dot{\psi}}\right)-\frac{\partial T}{\partial\psi}=0, && \text{.....(ii)}\\
&\frac{d}{dt}\left(\frac{\partial T}{\partial\dot{\phi}}\right)\quad\ =0. && \text{.....(iii)}
\end{aligned}\right\}$$

The first three equations integrate and give

$$P\dot{x}+(R-P)\sin\theta\cos\psi\,.\,w=H \quad \text{.....(iv)}$$

$$P\dot{y}+(R-P)\sin\theta\sin\psi\,.\,w=0 \quad \text{.....(v)}$$

$$P\dot{z}+(R-P)\,w\cos\theta\qquad\ =K-Mgt \quad \text{.....(vi)}$$

These equations will give $\dot{x}\ \dot{y}\ \dot{z}$ when θ, ψ are known.

From (ii) we have

$$\frac{d}{dt}\left(\frac{\partial T}{\partial\dot{\psi}}\right)-[(R-P)\,w(-\dot{x}\sin\psi+\dot{y}\cos\psi)\sin\theta]=0.$$

The second term may be put into the form

$$-\dot{x}[P\dot{y}+(R-P)\sin\theta\sin\psi\,.\,w]$$

$$+\dot{y}[P\dot{x}+(R-P)\sin\theta\cos\psi\,.\,w]$$

which by (iv) and (v) is equal to

$$\dot{y}H;$$

$\therefore$ integrating we have

$$\frac{\partial T}{\partial\dot{\psi}}-yH=\text{a constant } L \text{ say.}$$

Equation (iii) tells us that

$$\dot{\phi}+\dot{\psi}\cos\theta=\text{constant, } n \text{ say} \quad \ldots\ldots\ldots\ldots\ldots\ldots\text{(vii)}$$

Hence our previous integral may be written

$$A\dot{\psi}\sin^2\theta+Cn\cos\theta-yH=L \quad \ldots\ldots\ldots\ldots\ldots\ldots\text{(viii)}$$

The final integral is the equation of energy,

$$T+Mg\left(z-\frac{N}{P}\cos\theta\right)=E \text{ a const.}$$

Now squaring and adding (iv), (v), (vi), we get

$$P^2[\dot{x}^2+\dot{y}^2+\dot{z}^2]+(R-P)^2w^2+2P\,.\,R-P\,w\,.\,w=H^2+(K-Mgt)^2$$

or

$$P[P(u^2+v^2+w^2)+(R-P)w^2]+R\,.\,(R-P)w^2=H^2+(K-Mgt)^2 \ldots\text{(ix)}$$

But multiplying (iv), (v), (vi), by $\sin\theta\cos\psi$, $\sin\theta\sin\psi$ and $\cos\theta$ and adding we get

$$Pw+(R-P)w=H\sin\theta\cos\psi+(K-Mgt)\cos\theta$$

or

$$Rw=H\sin\theta\cos\psi+(K-Mgt)\cos\theta \quad \ldots\ldots\ldots\ldots\ldots\ldots\text{(x)}$$

Hence by (ix)

$$PR[P(u^2+v^2)+Rw^2]+(R-P)[H\sin\theta\cos\psi+\overline{K-Mgt}\cos\theta]^2$$

$$=R[H^2+(K-Mgt)^2]$$

Now the energy equation is

$$\{P[u^2+v^2]+Rw^2\}+A(\dot{\psi}^2\sin^2\theta+\dot{\theta}^2)+Cn^2+2Mg\left(z-\frac{N}{P}\cos\theta\right)=2E;$$

$$\therefore\ APR(\dot{\theta}^2+\dot{\psi}^2\sin^2\theta)+2MPRg\left(z-\frac{N}{P}\cos\theta\right)$$

$$-(R-P)[H\sin\theta\cos\psi+(K-Mgt)\cos\theta]^2$$

$$=(2E-Cn^2)PR-R[H^2+(K-Mgt)^2]\ldots\ldots\ldots\ldots\text{(xi)}$$

A better form for calculation is obtained by multiplying (iv), (v), (vi) by $\dot{x}\ \dot{y}\ \dot{z}$ and adding:—

$$P(\dot{x}^2+\dot{y}^2+\dot{z}^2)+(R-P)w^2=H\dot{x}+(K-Mgt)\dot{z}$$

$$\therefore\ H\dot{x}+(K-Mgt)\dot{z}+A(\dot{\psi}^2\sin^2\theta+\dot{\theta}^2)+Cn^2+2Mg\left(z-\frac{N}{P}\cos\theta\right)=2E\ldots\ldots\ldots(\text{xii})$$

3. If an elongated shot be fired from a rifled gun at an elevation β in the plane XOZ with initial velocity U and spin n we shall have as equations of motion,

$$\begin{cases} P\dot{x}+(R-P)w\sin\theta\cos\psi=RU\cos\beta \\ P\dot{y}+(R-P)w\sin\theta\sin\psi=0 \\ P\dot{z}+(R-P)w\cos\theta\qquad\quad=RU\sin\beta-Mgt. \end{cases}$$

[whence

$$Rw=RU\cos\beta\sin\theta\cos\psi+(RU\sin\beta-Mgt)\cos\theta]$$

$$\begin{cases} A\dot{\psi}\sin^2\theta+Cn\cos\theta-yRU\cos\beta=Cn\sin\beta \\ RU\dot{x}\cos\beta+(RU\sin\beta-Mgt)\dot{z}+A(\dot{\theta}^2+\dot{\psi}^2\sin^2\theta) \\ \qquad\qquad +2Mg\left(z-\frac{N}{P}\cos\theta\right)=RU^2-\frac{2MN}{P}g\sin\beta, \end{cases}$$

for initially

$$\theta=\frac{\pi}{2}-\beta,\quad \psi=0,$$

$$\dot{x}=U\cos\beta,\qquad \dot{y}=0,\qquad \dot{z}=U\sin\beta,\qquad w=U,\qquad \dot{\theta}=0,\qquad \dot{\psi}=0.$$

4. It is of interest to know at any rate the initial motion: to do this we expand $x\ y\ z\ \theta\ \psi$ in powers of τ the time that has elapsed since the beginning of the motion: thus:—

$$x=U\cos\beta\,.\,\tau+\frac{x''\tau^2}{2!}+\frac{x'''}{3!}\tau^3\ldots$$

$$y=\qquad\qquad\frac{y''}{2!}\tau^2+\frac{y'''}{3!}\tau^3+\ldots$$

$$z=U\sin\beta\,.\,\tau+\frac{z''}{2!}\tau^2+\frac{2'''}{3!}\tau^3+\ldots$$

$$\theta=\frac{\pi}{2}-\beta\qquad+\frac{\theta''}{2!}\tau^2+\frac{\theta'''}{3!}\tau^3+\ldots$$

$$\psi=\qquad\qquad\frac{\psi''}{2!}\tau^2+\frac{\psi'''}{3!}\tau^3+\ldots$$

Substituting in the three momentum and the first angular equation to the first power of τ we get

$$P[U\cos\beta+x''\tau]+(R-P)[(U\cos\beta+x''\tau)\cos^2\beta+(U\sin\beta+z''\tau)\sin\beta\cos\beta]=H$$

$$Py''\tau=0,$$

$$P[U\sin\beta+z''\tau]+(R-P)[(U\cos\beta+x''\tau)\sin\beta\cos\beta + (U\sin\beta+z''\tau)\sin^2\beta]=RU\sin\beta-Mg\tau,$$

and

$$A\psi''\tau\cos^2\beta+Cn\sin\beta=Cn\sin\beta.$$

Hence we derive

$$Px''+(R-P)(x''\cos^2\beta+z''\sin\beta\cos\beta)=0,$$

$$y''=0,$$

$$Pz''+(R-P)(x''\sin\beta\cos\beta+z''\sin^2\beta)=-Mg,$$

$$\psi''=0,$$

$$\therefore\ P[x''\cos\beta+z''\sin\beta]+(R-P)(x''\cos\beta+z''\sin\beta)=-Mg\sin\beta,$$

so that

$$x''=\frac{R-P}{PR}Mg\sin\beta\cos\beta,$$

$$z''=-\frac{P\sin^2\beta+R\cos^2\beta}{PR}Mg.$$

Substituting in the equations of § 3 to the second power of τ remembering that $y''=0$ and $\psi''=0$, and avoiding when possible useless terms, we get:—

$$0=P\frac{x'''}{2!}\tau^2+(R-P)\left[\begin{array}{l}\left(U\cos\beta+x''\tau+\frac{x'''}{2!}\tau^2\right)(\cos^2\beta+\theta''\tau^2\sin\beta\cos\beta)\\+\left(U\sin\beta+z''\tau+\frac{z'''}{2!}\tau^2\right)\left(\sin\beta\cos\beta-\frac{\theta''}{2!}\tau^2\cos2\beta\right)\end{array}\right]$$

$$0=P\frac{y'''}{2!}\tau^2$$

$$0=P\frac{z'''}{2!}\tau^2+(R-P)\left[\begin{array}{l}\left(U\cos\beta+\frac{x'''}{2!}\tau^2\right)\left(\sin\beta\cos\beta-\frac{\theta''}{2!}\tau^2\cos2\beta\right)\\+\left(U\sin\beta+\frac{z'''}{2!}\tau^2\right)(\sin^2\beta-\theta''\tau^2\sin\beta\cos\beta)\end{array}\right]$$

$$0=A\frac{\psi'''}{2!}\tau^2\cos^2\beta-Cn\frac{\theta''}{2!}\tau^2\cos^2\beta$$

$$0=RU\frac{x'''}{2!}\tau^2\cos\beta+(RU\sin\beta-Mg\tau)\left(U\sin\beta+z''\tau+\frac{z'''}{2!}\tau^2\right) + A\theta''^2\tau^2+2Mg\left[\frac{z''}{2!}\tau^2+\frac{N}{P}\frac{\theta''}{2!}\tau^2\cos\beta\right].$$

These five equations may be replaced by

$$0=Px'''+(R-P)[U\theta''\sin\beta+(x'''\cos\beta+z'''\sin\beta)\cos\beta]$$

$$0=Py'''$$

$$0=Pz'''+(R-P)[-U\theta''\cos\beta+(x'''\cos\beta+z'''\sin\beta)\sin\beta]$$

$$0=A\psi'''-Cn\theta''$$

$$0=RU[x'''\cos\beta+z'''\sin\beta]+A\theta''^2+\frac{2MN}{P}g\theta''\cos\beta.$$

The first and third give on eliminating θ'',

$$(x''' \cos\beta + z''' \sin\beta)[P + (R-P)(\cos^2\beta + \sin^2\beta)] = 0.$$

Hence the last equation is

$$\theta''\left[A\theta'' + \frac{2MN}{P} g\cos\beta\right] = 0.$$

In forming the energy equation, the Lagrangian equation

$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot\theta}\right) - \frac{\partial T}{\partial \theta} = \frac{\partial U}{\partial \theta}$$

had been multiplied by $2\dot\theta$, so that we expect a value of θ'' zero given by the energy equation in addition to the true value of θ''. Thus we take

$$\theta'' = -\frac{2MN}{AP} g\cos\beta$$

and then

$$\psi''' = -2\frac{CMN}{A^2P} gn\cos\beta.$$

In order to find the value of y^{IV} (y', y'', y''' all vanishing) we substitute in the second equation of linear momentum to third powers of τ: we get

$$0 = Py^{IV}\frac{\tau^3}{3!} + (R-P)\, U\cos\beta\,\psi'''\frac{\tau^3}{3!}$$

so that

$$y^{IV} = \frac{P-R}{P} U\psi'''\cos\beta$$

$$= -2\frac{CMN(P-R)}{A^2P^2} Ung\cos^2\beta.$$

For an ordinary elongated shot

$$P > R$$

and C, M, $(P-R)$, U, n are all positive, (an ordinary shot having spin put on it so that it describes a right-handed screw): hence the signs of ψ''' and y^{IV} are opposite to that of N, and the same as that of θ''.

It will be noticed that the value of θ'', namely $-\frac{2MN}{AP} g\cos\beta$, is independent of the velocity of projection, and of the spin: if then the shot be held with its axis horizontal and let fall, and the pointed or fore-end drop the quicker, then θ'' is positive and N is negative, and if it hit the ground with the hinder end N is positive: in the former case the shot will drift to the left and in the latter to the right.

As a matter of fact a shot from a rifled gun *always* drifts to the right (n being positive) and a homogeneous shot with a pointed end would fall point first (very slightly) though a shell (with a lighter fore-end) might remain horizontal when dropped. We conclude that

for these cases N is small compared with the other quantities and proceed to find the initial motion when N is zero.

5. In this case, $\theta''=0$, $\psi'''=0$, $y^{IV}=0$, initially and on expanding the variables in powers of τ, as before, we get from the third powers of τ

$$\begin{cases} 0=Px^{IV}+(R-P)(x^{IV}\cos\beta+z^{IV}\sin\beta)\cos\beta+(R-P)\,U\theta'''\sin\beta \\ 0=Pz^{IV}+(R-P)(x^{IV}\cos\beta+z^{IV}\sin\beta)\sin\beta-(R-P)\,U\theta'''\cos\beta \quad\ldots\ldots\text{(xiii)} \\ 0=A\psi^{IV}\cos\beta-Cn\,\theta''' \quad\ldots\ldots\text{(xiv)} \\ 0=RU(x^{IV}\cos\beta+z^{IV}\sin\beta)-Mgz''' \end{cases}$$

Hence as we have shown that $z'''=0$,

$$\therefore\ x^{IV}\cos\beta+z^{IV}\sin\beta=0 \quad\ldots\ldots\text{(xv)}$$

In order to determine θ''' we must consider the coefficients of τ^4 in the equations of motion. The first three and the last equations of motion give

$$\begin{cases} 0=Px^{V}+(R-P)[U\theta^{IV}\sin\beta+4\theta'''(\ddot{x}\sin 2\beta-\ddot{z}\cos 2\beta)+(x^{V}\cos\beta+z^{V}\sin\beta)\cos\beta] \\ 0=Py^{V}+(R-P)\,U\psi^{IV}\cos\beta \quad\ldots\ldots\text{(xvi)} \\ 0=Pz^{V}+(R-P)[-U\theta^{IV}\cos\beta-4\theta'''(\ddot{x}\cos 2\beta+\ddot{z}\sin 2\beta)+(x^{V}\cos\beta+z^{V}\sin\beta)\sin\beta] \\ 0=RU(x^{V}\cos\beta+z^{V}\sin\beta)-2Mgz^{IV}+6A\theta'''^2 \end{cases}$$

The first and third of these last equations give that

$$0=R(x^{V}\cos\beta+z^{V}\sin\beta)+4\theta'''(R-P)(\ddot{x}\sin\beta-\ddot{z}\cos\beta)$$

and by the last, remembering that we have proved that (xiii), (xv)

$$Pz^{IV}=(R-P)\,U\theta'''\cos\beta,$$

$$\therefore\ 0=-4U\theta'''(R-P)(\ddot{x}\sin\beta-\ddot{z}\cos\beta)-\frac{2Mg}{P}(R-P)\,U\theta'''\cos\beta+6A\theta'''^2$$

Also

$$\ddot{x}\sin\beta-\ddot{z}\cos\beta=\frac{Mg}{P}\cos\beta,$$

$$\therefore\ 0=2\theta'''\left[MgU\frac{(R-P)}{P}(2+1)\cos\beta-3A\theta'''\right]$$

As before we neglect the value $\theta'''=0$ obtained from the kinetic energy equation and take the root

$$\theta'''=-MgU\frac{P-R}{PA}\cos\beta \quad\ldots\ldots\text{(xvii)}$$

We write $-(P-R)$ instead of $+(R-P)$ because for an elongated shot $P>R$.

Our former equation (xiv) gives us

$$\psi^{IV}=-\frac{MUCng}{PA^2}(P-R) \quad\ldots\ldots\text{(xviii)}$$

whence by (xv)

$$y^{V}=-\frac{(P-R)^2}{P^2}\frac{MC}{A^2}gn\,U^2\cos\beta \quad\ldots\ldots\text{(xix).}$$

6. The way in which drift arises may be seen by considering the Lagrangian equation (i) remembering that N is now zero. If u_1 represents the velocity of the centre of gravity in the direction $\theta + \frac{\pi}{2}$, ψ this equation reduces to

$$A\ddot{\theta} - A\dot{\psi}^2 \sin\theta\cos\theta + Cn\psi\sin\theta = -(P-R)\,u_1 w.$$

From this initially, since $\dot{\psi}$, $\dot{\theta}$, u_1 then vanish

$$A\ddot{\theta} = -(P-R)\,\dot{u}_1 w$$

where

$$\dot{u}_1 = \ddot{x}\sin\beta - \ddot{z}\cos\beta = \frac{Mg\cos\beta}{P}.$$

Thus the fact that the tangent to the path of the projectile gradually drops below its initial direction leads not (as has been stated) directly to a diminution in the value of ψ but to a diminution in θ, and when the axis rises the condition of constant angular momentum about a vertical through the point of projection makes the shot point to the right.

The subsequent angular motion is that of a rigid body of principal moments A, A, C under the action of a field whose force-function is $(P-R)\,w^2$.

FIELD ARTILLERY FIRE.

BY

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CHAPTER III.

Effective Fire.

The great desideratum being to open an "effective fire" before the enemy can do so, it will be as well to investigate what is meant by effective fire, before dealing with the methods by which it may be arrived at.

The projectiles of the 12-pr. B.L. gun with which the effect is to be produced are, in our service, at present as follows:

A case shot containing 314 bullets at 34 to the pound.

A shrapnel shell containing 177 bullets at 34 to the pound and having its bursting charge in the head.

A common shell of forged steel, containing a bursting charge of 1½ lb. and breaking up on explosion into some three or four pieces.

In order to compare our projectiles with those of foreign artilleries, a table showing the leading characteristics of foreign field guns is added, Chapter XI.

The principal differences in the ammunition of foreign countries as compared with our own are:

a. That they all use an iron ring shell in preference to a common shell of steel or iron. These ring shell break up into from 100 to 160 pieces. The French use neither common nor ring shell, except for high explosives, but in lieu thereof use their old shrapnel "obus à balles" which carries its bursting charge down the centre.

b. All shrapnel have the bursting charge in the base, except the French "obus à mitraille," which, like our own, has it in the head.

c. Germany and France have adopted a high explosive for use as the bursting charge of a certain proportion of common shell.

d. The weight of the bullets in foreign case shot greatly exceeds that of our own. We have bullets at 34 to the pound, the others vary from the German at 6½ to the pound to the Italian at 20 to the pound.

Case shot. The circumstances under which case shot can be used are so very restricted that it will be as well to dismiss that projectile first.

Our case shot, on account of the lightness of its bullets, can only be claimed to be useful up to 400 yards, whereas some of the foreign powers claim an effective zone of 600 yards, but, per contra, our projectile at the shorter ranges has an immensely superior number of bullets. It is curious to observe that the Germans, with the heaviest bullet of all, only claim an effective range of 300 metres, whereas the French with a bullet of 11 to the pound claim an effective range of 500 metres.

It is comparatively seldom that case shot is used against infantry, for the reason that they would probably not venture into the zone of case shot fire until the guns were partially silenced, for instance, if an enemy attacking our guns arrives at about 450 yards he could silence them by rifle fire before entering the deadly case zone. Case is therefore more often used against a sudden rush at the guns by cavalry or a fanatic enemy unprovided with firearms, and may be considered from that point of view.

When such an attack is expected all the case should be brought up to the guns, for, in the last two minutes of a cavalry charge, when it must be stopped or be successful, there is not sufficient time for service from the limber.

The time when it is considered necessary to cease the fire of shrapnel, and, having loaded with case, to await the entrance of the enemy into the 400 yard zone, must depend upon the state of training of the battery. In our service it is thought that this change should be made when the enemy is within 600 to 700 yards. The short pause that ensues has the advantage of steadying down the battery before the critical moment. Abroad they make arrangements for a very rapid fire of time shrapnel up to the actual moment when case shot fire commences. This is done by causing all fuzes, which are carried fixed in the shell, instead of being carried set at zero, to be always set for such a distance as is just beyond the effective range of case; in Germany they are carried set so as to burst the shell at from 150 to 200 metres from the gun. Thus, at a very critical period, no setting of fuzes is required and a very rapid fire can be kept up continuously. A somewhat similar plan has just been adopted into our service.

The principal errors in the administration of case shot fire in our service are:

a. That when case shot fire is ordered the fire of the battery often becomes independent. This is a grave fault, for it is generally recognised that when the fire of a battery becomes independent the battery is out of hand. The proper rate of fire and the most rapid permissible is "Rapid fire by sections." The fire is thus thoroughly retained in hand and some of the guns

of the battery are always loaded. If anything like independent fire begins it generally commences with a straggling salvo, after which the men, knowing that all the guns of the battery are empty, and that the enemy is close upon them, become hurried, and hurry soon degenerates in confusion. It is this feeling of uneasiness that has led the Germans to veto the firing of salvos, which would otherwise be very effective, under such circumstances.

If the Battery Commander wishes to keep the fire entirely in his own hands, rather than delegate it to the sectional officers, then salvos of half batteries would give a steady and effective fire and the men would feel that, there being always some guns loaded, they would never be in a quite defenceless state.

b. It is very much too slow. This arises from several causes—

1. For want of a timely warning to "Prepare for case" it is not brought up from the limbers in time, and it often happens at practice that there is none carried on the gun. The command "Prepare for . . . . ." is not thoroughly understood, it will be discussed later on in Chapter X.

2. Although it is so laid down in the drill-book, it is difficult to make the men understand that there is no time for running up the gun after each round, indeed it requires very stringent orders to prevent them doing so, as they have been taught to do so under every other circumstance, and it is moments such as those when case shot fire is resorted to that the mechanical phase of a man's training is most apparent.

3. The gun-layers are much too long over the laying. This arises from the fact that, at practice, the object is merely a small moving target, three or four feet across, whereas, on service, the front of the target would probably greatly exceed that of the battery. The elevation that it is necessary to give is merely approximate and no time should be lost in setting and clamping a tangent scale. Abroad a usual custom is for the gun-layer to put either one or two fingers, as ordered, on the head of the tangent scale, which is at zero, and lay over them and the foresight; this approximation to the elevation is quite sufficient, accuracy of direction is of no moment and the procedure is much more rapid. The elevation as given in the range table is that suitable for ground of average hardness when certain of the bullets will ricochet, on soft ground double the amount of elevation should be given.

It must be remembered that when all the case shot of a battery are expended it is no longer possible, with B.L. guns, to revert to the old muzzle-loading expedient of using reversed shrapnel, but very fair effect may be got by using time shrapnel with the fuze set just beyond zero; the shell will then burst just clear of the muzzle.

In order to prevent the waste of time in accurate laying in case shot fire, it is not a bad plan, at practice and drill, to cause the section

officers to remove the tangent scales and make the gun-layers lay over their fingers as described above.

For the sake of experience all case shot practice should be at a running target.

Common shell. As has been stated, our forged steel common shell breaks up into but three or four pieces, the chances of these doing much damage to *personnel* is comparatively slight and it cannot be looked upon as a man-killing projectile. Its value therefore consists in its comparatively large bursting charge. The chief merit of this is that it gives a large cloud of smoke on bursting and also has a certain amount of local destructive effect on cover. The first point is one of great utility during the important process of ranging, but two much weight must not be attached to the second. The destructive power of any common shell fired from a field gun (this does not include, of course, field howitzers and mortars) upon field works, even of a light description, is very small and quite disproportionate to the amount of time and ammunition expended. Indeed the reduced proportion of common shell carried by our batteries renders any large expenditure of that projectile for this purpose quite out of the question, and the French have gone still further, in altogether banishing the powder-loaded common shell from their field batteries. As regards the destruction of cover such as houses, the comparatively large bursting charge is likely to set them on fire, which is undesirable if we want to drive out the enemy with a view to occupying them ourselves, and the want of man-killing effect would enable the enemy to withdraw with but little loss. For this purpose a percussion shrapnel, or, if we had it, a ring shell, is much preferable.

It is a very common error, inculcated by the older text-books, to suppose that when engaging artillery, common shell should be used with the hope of destroying the guns themselves. It is quite true that in the campaign of 1870 the Germans produced very good effects against artillery with common shell, or rather ring shell, but the silencing of the enemy's guns was not produced by the destruction of his *matériel* but by the disablement of his *personnel*, a result which would have been brought about the sooner by the use of shrapnel shell, had the Germans been provided with an efficient pattern of that projectile. The following extracts will prove the truth of this assertion.

Speaking on the same subject Prince Kraft says:

"In the great battle of Königgratz (1866) we captured nearly 200 guns; not one in the whole number, as far as I know, had been injured by fire . . . . With respect to all the many guns which were lost, the reports of the victorious infantry declare that they in general captured only such guns as had lost their teams by fire, the others succeeded in escaping."

General Sheridan at Gravelotte speaking of the silence of the French artillery after the artillery duel at that end of the field says:

"Their artillery was silent however; and from this fact the German artillery officers grew jubilant, confidently asserting that their Krupp guns had dismounted the French batteries and knocked their mitrail-

leuses to pieces . . . . As they (the German infantry) approached within short range they suddenly found that the French artillery and mitrailleuses had by no means been disabled, about 200 pieces opening on them with fearful effect."

Prince Kraft at St. Privat.—"During our advance on St. Privat and during the artillery fight which followed, against the enemy's guns on the hill of St. Privat, my batteries suffered considerable loss from the enemy's shells. I saw some limbers blown up and many guns during the cannonade lying miserably on the ground 'winged,' that is with a broken wheel. But not one was withdrawn, the injured guns were always soon repaired by the aid of the wagons, which stood very near to them, so that, after the battle, I could not exactly tell how many guns (out of 84) had been put temporarily out of action. But when, towards evening, it was necessary to support the infantry in their attack, everything had been so entirely repaired during the unceasing cannonade that three guns only could not immediately be brought up and had to be left in rear . . . They remained where they were, refitted and followed us as soon as possible to the new position."

"At Sedan one gun of mine became altogether unserviceable. The gun had burst."

From the above it may be gathered that the silencing of artillery is not produced by disablement of *matériel* but by the losses among the men.

The following are the losses of the six batteries on the left of the artillery position of the IX German Corps on the 18th August, 1870, losses which resulted in the total silencing of one battery, the 4th heavy, and the temporary silencing of others.

	Officers.	Men.	Horses.
Total strength of batteries	24	893	839
With 1st line, in action	24	384	336
Total losses	17	187	370

Take the worst case of the above, the 4th heavy battery—

	Officers.	Men.	Horses.
Total strength of battery	4	151	126
With 1st line, in action	4	62	48
Total losses	3	45	49

This last battery brought two guns out of action, and four were captured by the French.

All things considered, we may take it that our forged steel common shell may be regarded only as a ranging projectile. This being the case, what we are really concerned with in this question of effective fire, if we exclude the few occasions upon which case shot is used, is the use of shrapnel shell, which is the field artillery projectile *par excellence*.

Shrapnel shell. The action of shrapnel shell being described in detail in the drill-book it is proposed in this place, merely to state briefly the points upon which the following chapters are based.

1. That except in cases where actual penetration of cover is required, or when time does not permit of the setting of time fuzes, the action of time shrapnel is more effective than that of percussion shrapnel, and, as a rule, it is easier to obtain good effect with it.

2. That the angle of opening of the shell is from 12 degrees at short ranges to 18 degrees at long ranges.

3. That it is impossible to observe from the battery how far back from the target the shell are bursting, but if we know that the trajectory of the shell is correct, we can, by observing the height of the burst above the line of sight and referring to the slope of descent, as given in the range table, ascertain, if we wish to do so, the exact distance that our shell are bursting short of the target.

4. That the height that we wish to see a shell burst at, when using it against an extended formation is, in feet, two-thirds of the number of hundreds of yards in the range, *i.e.* if the range is 3000 yards we wish to see the shell burst 20 feet up in the air. Another way of measuring the height of burst, and very easily done with a telescopic sight, is to measure the angle between the point of burst and the point aimed at, in the above case this would be eight minutes. At targets having a small front, such as a gun, or against deep formations, such as a column where depth of effect is required, it is desired to burst the shell closer up and the distance is placed at half the above, in the above example it would be 10 feet and 4 minutes respectively. Also when using time shrapnel against troops behind parapets it is useful to get a burst as close up as possible in order to get the extra searching power given by the angle of descent plus the semiangle of opening of the lower half of the cone of dispersion.

   These two angular measures are universal for all ranges. We may therefore say that if we know the trajectory to be correctly established and we see the shell bursting at 8 or 4 minutes above the target, as required, we shall know that they are bursting at the right place and need not trouble ourselves about how far back they are from the target.

If we were to start firing time shrapnel at once we could not, except at very short ranges, see whether they were bursting in the right place or not or even if they were short or over the target. It is therefore necessary, before we can get an effective fire of time shrapnel, to arrive at two things.

1. The correct amount of elevation required, *i.e.* to establish the trajectory.
2. The correct length of fuze required to burst the shell at the proper point in that trajectory.

The process of finding the above is termed "RANGING."

CHAPTER IV.

Ranging.[1]

The object of the process of ranging is to find out, irrespective of the distance in yards, what elevation must be given to the guns in order that the mean trajectory of the battery may pass through the centre of the target, i.e. the relative range, and to determine the correct length of fuze.

Here be it noted that, the object being to adjust the mean trajectory of the BATTERY, it must be wrong to range only with one or two guns as the process will then only give us the mean for the guns used. It was a practice that was very prevalent in the early days of the modern system of fire discipline and the two best layers in the battery were generally told off to the duty, but however satisfactory it may have been to the two guns concerned it was quite problematical whether the trajectory so established was suited to the laying and guns of the remainder of the battery.

It is of course a great assistance, as a starting point, to know the actual distance in yards to the target, *i.e.* the real range, as this knowledge will give us an approximation to the elevation required and eliminate the personal error in judging distance. This information may be got with a very small percentage of error, by the use of the range-finder, but as this instrument may not always be available and there are so many other factors, of such variable nature that have to be taken into consideration, which render it necessary that actual experiment should take place before efficient fire can be opened, that the question of ranging will first of all be considered by itself and then the amount of assistance to be derived from the use of the range-finder will be pointed out.

The principal of these variable factors that influence the trajectory are :

1. Variations in the performance of the powder, dependent on climatic and atmospheric conditions, which naturally vary, even from day to day.

2. Force and direction of wind.

3. Variations in the nature, etc. of the powder, owing to difficulties of manufacture, age, the amount of jolting about in the limber that it has received, etc. The following example is selected on account of the great care with which the laying was carried out, which shows that the result arose from the variation in powder.

   20 rounds 6·6-inch howitzer. 2 lbs. charge. Range about 1100 yards.

   A single howitzer was used and was laid very carefully each time by clinometer.

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[1] For selection of ranging point *see* chapter on "Observation of Fire."

5 cartridges of another batch, of the same weight, previously made up, got mixed up with those prepared for this practice with the following results:

15 cartridges gave a mean point of impact 19 yards short of the target.

5 cartridges gave a mean point of impact 158 yards short of the target.

Difference 139 yards or about 13 per cent of the range.

4. Nature of the ground, as influencing the "jump" of the gun.

It appears then that it would be very unwise to accept any distance, however carefully measured, as the correct elevation for the range, but this distance must be carefully proved and verified by a system of trial shots.

A leading feature of any system of ranging must be simplicity, not only in order that it may be quickly mastered and kept up without perpetual rehearsal, but also that it may not break down under the stress of practical application in the field. Many schemes have been propounded on the Continent, of which a large number have been abandoned solely on this ground of complication, though promising well in other respects such as rapidity and accuracy.

The groundwork of all modern systems of ranging is what is termed the "bracket system." The method of application in our service, as we find it laid down in "Field Artillery Drill," Vol. II., and modified by the periodical instructions for practice, is one of great simplicity. We will take it as a type, also discuss some of the methods obtaining abroad, and deduce the broad principles upon which all the systems are founded.

The ordinary German method and our own are so much alike that we may take them together.

On coming into action all the guns are loaded with percussion projectiles and it must be thoroughly understood that this loading is to be repeated until it is stopped or changed by order of the C.O. in order that he may not have to think about orders for loading when his mind is employed with other matters.

All the guns are layed at the elevation ordered, that is for the elevation due to the estimated range. The French vary this slightly, they contend that it is easier to start from the observation of a round that is short, it is therefore ordered that the first round shall be fired at an elevation less by some 200 to 300 metres than the estimated range. The Germans order that if the first round is over the elevation of the second shall be so reduced that the next round shall fall short. Where the observation of rounds over is difficult it certainly appears wise to ensure the first round being short, but where a range-finder is used the first shell will very possibly fall sufficiently near the target to be observed with ease.

If the first round is observed short increase the elevation by an amount equal to about one-tenth of the range; that is, if the range is

between 2000 and 3000 yards increase the elevation by 200 yards.

3000 and 4000	,,	,,	,,	300 ,,
4000 and 5000	,,	,,	,,	400 ,,

if the next round is again observed short increase again by a like amount and so on until a round is observed to burst "over." The "LONG BRACKET," is then said to be found.

The amount of increment may appear excessive but it is better to err in this respect than to fall into the error of making small corrections and thus, if the amount of correction really required is a large one, "creeping up" to the range at the cost of a larger expenditure of time and ammunition.

NOTE.—When a correction in elevation is ordered it is made by all the guns and not only by the one about to be fired.

If the first round is observed over the converse of the above operation takes place.

Example—

2400 yards	...	...	short.
2600 ,,	...	...	,,
2800 ,,	...	...	,,
3000 ,,	...	...	over.

The "Long Bracket" is, in this case, between 2800 and 3000 yards. From this bracket we now proceed to find the "SHORT BRACKET," which in our service as in the German, is taken at 50 yards, or metres, the method is to fire a round, or rounds, at the mean of the last two elevations that have been observed to bracket the target.

Thus, in our example, a round is fired at 2900 yards, which is observed over

2900 yards	...	...	over.

The target is now known to be between 2800 yards, which was short and 2900 yards, which was over; a round is now fired at the mean of these two last elevations

2850 yards	...	...	over.

The target is now between 2800 and 2850 yards, or a bracket of 50 yards, which is known as the short bracket.

The short bracket being established a series of four, six or more shell, known as the "VERIFYING SERIES" is fired at the mean of the elevations of the short bracket. (In France and Germany at the lower of these two elevations.) If the target is a horizontal one of no great depth, such as a line of skirmishers, one-third to one-half of these rounds should be observed "short;" if the target has height one-fourth to one-third of them should be observed "short." If these conditions are not obtained a correction of 25 yards plus or minus may be made and the process repeated if the range is a long one and the target stationary, but it is generally the custom to pass to shrapnel fire without firing another verifying series.

In cases where the target is of a transitory nature there will not be time to verify the range and shrapnel fire will have to be opened at the

lower elevation of the short bracket without waiting to verify. The space covered by the bullets amply compensating for any small error in the elevation.

Under ordinary circumstances it is not of much use to make a correction of less than 25 yards, as this distance represents, approximately, the average 50 per cent. rectangle of most field guns at fair service ranges. To continue the example—

Verifying series ... { 2825 yards ... ... short
" " ... ... over,
" " ... ... short.
" " ... ... over.

We may therefore say that with an elevation of 2825 yards the mean trajectory of the battery will pass through the centre of the target. Now at ranges over 2000 yards and up to the limit at which the small time and percussion fuze can be used the shrapnel shell travels about 25 yards further than the common for the same elevation[1] the Battery Commander, before communicating the verified range to the battery would deduct 25 yards; the word of command would then be KEEP TO 2800 YARDS.

Suppose that the above proportion of overs and unders has not been obtained and that three were short and one was over; the Battery Commander will be perfectly right to assume that his range is very nearly found but that it is the least thing short, a correction of 25 yards will give it to him and he will therefore think 2825 yards plus 25 yards is the correct range for common shell and he must knock off 25 yards before passing to shrapnel therefore the word of command will be KEEP TO 2825 YARDS. If three were over and one was short then 2825 is a little too long and 2825 minus 25 yards would be the correct elevation for common shell and if the correction be made for shrapnel the word of command will be KEEP TO 2775 YARDS.

Important points to be observed in Ranging.

In order to avoid a very fruitful source of error, any round about the observation of which there is any *doubt* is ON NO ACCOUNT TO BE TAKEN INTO CONSIDERATION AS A BASIS FOR CORRECTIONS. Another round should be fired at the same elevation. Otherwise one round wrongly observed will probably necessitate the repetition of the whole operation.

When the whole of a series depends upon the correct observation or laying of one round, that round should be carefully repeated and verified.

There are two common instances of this.

A round, say the first, is observed to strike the target, it would not do to accept the elevation of that round as quite correct because the gun might have been badly laid but the verifying series should be commenced at once at the elevation at which that round was fired. (*See* Also Chapter on Observation of Fire). The other case is where

[1] When the middle time and percussion is used the shrapnel travels 150 to 200 yards *less* than the common shell for the same elevation.

there has been a long succession of rounds all in the same sense, *i.e.*:

4400 over.
4000 short.
4200 „
4300 „
4350 „

It is obvious that in this case the whole of the series depends upon the correct observation of the first round and it would not do to pass to shrapnel fire without at least firing one more round at 4400 to make quite sure that that first round was over.

Having now thoroughly established the trajectory we will consider the passage from common shell to shrapnel shell. We will suppose that the target is an extended one and therefore, at the range 2800 yards it will be desired to get a burst about 20 feet up.

No. of Round.	No. of Sub-Division.	Elevation.	Projectile.	Length of Fuze.	Result as judged by C.O.		Words of Command, with reference to passage to shrapnel, as given after the rounds against which they are placed.
					+ — or ?	Height of burst.	
		Yards.				Feet.	
1	1	2400	C.	...	—	...	
2	2	2600	C.	...	—	...	
3	3	2800	C.	...	—	...	
4	4	3000	C.	...	+	...	
5	5	2900	C.	...	+	...	"Prepare for Shrapnel. Left Section, Fuze 14". (*a*)
6	6	2850	C.	...	+	...	
7	1	2825	C.	...	—	...	
8	2	...	C.	...	+	...	
9	3	...	C.	...	—	...	
10	4	...	C.	...	+	...	"Keep to 2800 yards." (*b*)
11	5	2800	S.	14	...	40	
12	6	...	S.	14	...	32	"Right Section Fuze 14½." (*c*)
13	1	...	S.	14½	...	10	
14	2	...	S.	14½	...	14	"Centre and Left Sections Fuze 14¼." (*d*)
15	3	...	S.	14¼	...	24	
16	4	...	S.	14¼	...	16	"Right Section Fuze 14¼." (*e*)
17	5	...	S.	14¼	...	22	
18	6	...	S.	14¼	...	17	"Keep to Fuze 14¼." (*f*) Ordinary Fire.
19	1	...	S.	14¼	...	20	
20	2	...	S.	14¼	...	22	

(*a.*) After the 5th round the C.O. having got the target within a bracket of 100 yards, can forsee the end of the series, and, by the time the fire has got round to number 5 gun again, he will want no more common shell. After round 5 therefore he gives the word "Prepare for Shrapnel." This applies to the whole battery and means that when the common shell in the guns are fired the guns are to be relaid and the No. 3 of each is to stand with a shrapnel shell and time fuze in his hand ready to set the fuze. But the C.O. does more than this for the Left Section, one gun of which, No. 5, is empty and the other about to be fired, he completes the word of command by giving them a length of fuze so that the loading of that section can be completed. Thus there will be no pause in the fire when he comes round to them again. He gives "Left Section Fuze 14;" that is, the fuze for the lower of the last two elevations that have bracketted the target, which cannot be very far off the length required and at all events is good enough for the first two trial fuzes. To get the approximate length of fuze it is quite sufficient to divide the number of hundreds of yards by two, thus for 2800 yards fuze 14 will be very nearly right, the range table is thus dispensed with. Trial fuzes must always be set by sections as, being variable in their burning, it is better to take the mean of two bursts as a datum for corrections.

(*b.*) *See* page 206.

(*c.*) The mean of rounds 11 and 12 gave a burst of 36 feet, which is too high, the fuze for the next section is therefore lengthened by one-half. (At least one-half should be taken to avoid creeping up.) After round 12 the word "Right Section Fuze 14½" is given. The Left and Centre Sections relay their guns and stand ready to load with shrapnel as soon as they get a length of fuze given to them.

(*d.*) The mean burst of rounds 13 and 14 being 12 feet up, and therefore too low, the fuze has to be shortened; but, by this time, the C.O. can see that the length of fuze will probably be 14¼, he therefore desires to fire a verifying series and orders, after round 14, "Centre and Left Sections Fuze 14¼."

(*e.*) The mean of rounds 15 and 16 being 20 feet, or the distance required, in order to avoid having a pause in the fire after round 18, the C.O., after round 16, gives the word "Right Section Fuze 14¼."

(*f.*) The mean of rounds 15, 16, 17 and 18 being very nearly 20 feet, after round 18 the C.O. gives the word "Keep to Fuze 14¼, Ordinary Fire." The guns of the Right Section being already loaded there is no pause.

In cases where the target is at all indistinct or where, there being no telescopic sight available, there are difficulties in estimating the exact height of burst it is better to lengthen the fuze until a series of bursts

on graze are obtained and then shorten the fuze by one-quarter or one-half. By this means the burst of the shell within an effective distance of the target is ensured.

Error of burning of the Fuze. Taking the result of many rounds fired at battery service practice by a well-trained battery, it has been found that with the small time and percussion fuze the mean error of burning is about 19 yards. This of course takes into account not only the variable burning of the fuze but also a certain amount of indifferent setting of the fuzes, which after all is a service condition.

It will be seen therefore that if it is desired to get a mean point of burst within about 100 yards of a target that a certain proportion of the shell will burst on graze.

Fuze scale. The fuze scale is merely approximate and is compiled for the burning of the fuzes at the sea level. The higher the altitude the slower burn the fuzes on account of the diminished supply of oxygen and the diminished pressure of the air. Rules are given in the drill-books for calculating this increase in the length of burning but calculations of this sort are little to be trusted in the field and all information required may be got from the first pair of trial fuzes if they be set sufficiently short to burst in the air and not on graze.

To find the correct length of fuze. In this portion of the process of ranging the same general rule applies as in the former portion, viz., that a creeping style should be avoided as leading to a waste of time and ammunition.

Alterations should be bold, that is, of not less than ·5, with a metal time fuze. If the correction is bold then the target is soon bracketted between two lengths of fuze, one too long and the other too short; the amount short may be seen by observation and the difference between the two lengths split in the proper proportion to give the correct height of burst.

It is when shell burst on graze that the boldest alterations are necessary, and at long ranges one or two whole divisions is a permissible alteration, because it is impossible to tell how much too long the fuze is. As an example, an officer firing at a range of about 3800 yards and using the middle time fuze, gave the first pair of fuzes 25, these burst on graze, he then came back ·5 at a time firing two fuzes at each length, until he got to 21·5 which was the correct length. He thus took 16 shell before he arrived at the right length, which then had to be verified. If he had made a bolder alteration he would probably have found the correct length in 6 or 8 rounds.

In ranging for length of fuze, or afterwards, alterations should never be made on the result of the observation of one round. Trial fuzes should always be fired by sections and the mean of two bursts taken as the basis for corrections.

Corrections for deflection. In order to facilitate observation it is important that the guns during ranging should be carefully laid for direction and it is the duty of the sectional officers to assist the Battery Commander by attending to this.

A lateral deviation is not always caused by the wrong setting of the deflection leaf, it may sometimes be the result of the natural dispersion

of the piece, *i.e.*, the breadth of the probable rectangle. For this reason it is not necessary to correct the deflection after a single round, unless the deviation observed exceeds the breadth of the probable rectangle. If it is less than this amount the mean of several rounds must be taken as a basis for correction.

The deflection for each gun varying according to the position of the wheels (except when Scott's sights are used), the proper correction must be made for each by the gun-layer and the Sectional Officer is responsible that it is made. In the case of a strong side wind the correction will apply to all and will be ordered by the Battery Commander. When Scott's sights are used this deflection given by the C.O. for wind should include that necessary to compensate for drift.

As observations for lateral corrections can best be made from a position near the gun itself, these corrections are the business of the Sectional Officers.

Mental calculations are very little to be relied upon in the field and it will be found better, instead of calculating out a correction for deflection to make a bold alteration which will probably bring the projectile to the other side of the target and then split the difference, in fact to apply the bracket system, which has always been found quicker than any creeping up.

Amount of assistance to be got from the Range-Finder in ranging. The advantage of the range-finder is that the great errors that arise in judging distance are eliminated, and we may therefore hope that the elevation as given by range-finder will place our first round somewhere close to the target. But, owing to the variable factors influencing the trajectory, mentioned in the beginning of this chapter, it would not do to accept this elevation without verification. A verifying series might be fired at once at the elevation so given, but this might lead to loss of time and to creeping up to the target, it is better therefore to attempt at once to find the small bracket, or at long ranges a bracket of 100 to 200 yards, by this means the process of ranging is considerably shortened. Thus, if the range-finder gives 2710 yards :

1st round, elevation 2700 yards short.
2nd ,, ,, 2750 ,, ,,
3rd ,, ,, 2800 ,, over.

Let us assume that the range is verified to be 2775 yards, that is to say that in order to make a shell travel a measured distance of 2710 yards it is necessary to put up elevation for 2775 yards, this difference of 65 yards is known as THE ERROR OF THE DAY and will vary according to atmospheric conditions, state of powder, &c.

The value of knowing the error of the day is this, that, at the second or later series, the knowledge can be made use of in shortening the process of ranging. Thus, suppose the next range as given by range-finder is 2325 yards, the error of the day is known to be 65 yards, the elevation for that range will therefore be 2390 yards.

1st round 2400 yards over.
2nd ,, 2350 ,, short.

It would not be safe to omit bracketting the target because the range-takers might have made a mistake.

SUCCESSION LIST

OF THE

MASTER-GUNNERS OF ENGLAND.

BY

MAJOR R. H. MURDOCH, R.A.

(Assistant Superintendent R.A. Records).

In redeeming, to-day, the pledge given in footnote on page 9 of "The Master-Gunner of England," *Proceedings R.A. Institution, Vol. XIV., No. 3,* I regret the delay, which has been unavoidable.

The *Succession List* is even now incomplete—not because of *data* being non-existent, but of the impracticability of a non-resident in London devoting sufficient leisure to get at them, involving as such research does the functions of a British Museum book-worm, or faded parchment Rolls Court moth.

The Authorities are too numerous for quotation—consisting of Exchequer receipts, &c., Treasury issues, "Garde-robe" accounts, parchment rolls, Rymer's *Fœdera,* Royal and Ordnance Warrants, Harleian and Cleaveland MSS., Grose's and Leland's Antiquities, &c. The Cleaveland Memoirs have been particularly useful; but discovery of several important errors in these generally accurate MSS. necessitated verification by references to the original sources.

Regimental historians have hitherto been content with fixing the birth of the Royal Artillery at the permanent establishment, in 1715, of the last "Train of Artillery." The disbandment of "Trains" was a legal fiction—to comply with the constitution, prior to first *Mutiny Act* of William III.—as an Artillery force was continuous from the dawn of the 13th century; and this *Succession List* presents, in a succinct form, a retrospective outline of Artillery history during the five hundred years preceding 1715. There is inductive evidence that the Roger de Leyburn of A.D. 1265 had, for executive, a Fleming, and that Flemish experts continued to instruct Artillerymen down to the end of the Tudors. The *Master-Gunner of Scotland* (Johannis Crab), so early as 1319, is described by his contemporary as a "Flemyng"—"that was of so gret sutelté,"—although Bourne, in his "Art of Shooting" (printed A.D. 1587), attributes to Henry VIII. the regular introduction of Flemish *Magistri:* but the insular English antipathy to foreigners during the reigns of the immediate successors to the unfortunate King John may account for what appears to have been designed concealment of names of the earliest Master-Gunners.

There is an indefinable, incommunicable pleasure in delving among

the faded, original *data* of past ages, out of which history is builded;[1] and in thus being enabled in viewing the circumstances of to-day to recognise whence they sprang, with the motives and developments which have conspired to produce them—a feeling akin to that with which, for instance, any one who has sat much at the feet of the discoursers in the Platonic dialogues readily identifies the *pabulum* which supplies so much of what is called advanced thought of to-day, and detects the leavening influences on human history. But one cannot rise out of such abstraction without being weighted with the consciousness that the history of Artillery is not so much that of "civilisation and progress" as that of "individualism;"[2] and that the proud title and potentialities of the office of *Master-Gunner of England*—England's Master-Gunner-in-Chief—have been magnified or marred, not by "civilisation and progress," but by the ability or otherwise of the individual incumbents, from which their successors have profited or suffered ("for no man liveth unto himself," even in this respect).

Both the *hour* and the *man* met, for instance, in Christopher Morris (A.D. 1523): a greater *hour* was before Richard Leake, the agéd (A.D. 1677); but the *man* was unequal to it, and his bishopric was taken away and given to another order of incumbents—the office itself degenerating into that of the *Master-Gunner of the Royal Parks.*

L'Histoire de l'Artillerie est l'histoire du progrès des sciences et partant de la civilisation[3] is synthetically true, couched in Imperial language; but did Artillery owe as much to civilisation and progress as to Gustavus Adolphus or to Napoleon the Great, or to the genius of Von Moltke?[4] Even so, the history of the development, organisations and progress of the Royal Artillery, when it comes to be written impartially and comprehensively, will be epoched in much by the Arts, but in much more by the dominant individualisms of Legge, Borgard, Belford, Dickson, Ross, Campbell, Bingham, Cole, and one or two of their successors who have made the Royal Artillery of to-day.

* * * * * * * *

In my contribution to the archæology of Artillery—referred to above as *The Master-Gunner of England*—the following passage on page 96:—

"*Hence the origin of the first motto of the Board of Ordnance* (instituted as the Ordnance Office by Queen Elizabeth, 1602), *Sua Tela Tonanti*—a motto which, for the Ordnance Arm, was changed by King William

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[1] Indeed, a writer in the *Spectator* asserts: "I have heard one of the greatest geniuses this age has produced, who had been trained up in all the polite studies of Antiquity, assure me, upon his being obliged to search into several rolls and records, that, notwithstanding such an employment was at first very dry and irksome to him, he at last took an incredible pleasure in it."—*Spectator, No. 447.*

[2] The "Law of Wills and Causes," and the influence of individualism on human progress are splendidly handled by John Beattie Crozier in his *Civilisation and Progress* (Longmans); and in Samuel Laing's *Modern Zoroastrian,* whose "Law of Polarity" is the equation of Crozier's "Wills."

[3] Napoleon III. Vide "The Master-Gunner of England," page 13.

[4] So recently as during the Crimean War (1854) the Isle of Wight entrances to the Solent were guarded by two toy forts (built temp. Henry VIII.), and manned by Henry VIII's. brass 6-prs.; and the heaviest ordnance for Fort George, Freshwater, in replacement, were 18-pr. M.L. guns of George II. (the 32-pr. being only a carronade). Had "Science and civilisation" slept during this long interval?

IV. into the present *Ubique, quó fas et gloria ducunt,*" requires some

modification, for which the present moment may be the most opportune. In penning the passage, that the Tudor *motto* was changed by order of King William IV. into *Ubique, quó fas et gloria ducunt,* I adhered to the following—

General Order.

"The King has been pleased to grant to the Royal Regiment of Artillery and Corps of Royal Engineers His Majesty's permission to bear on their appointments the Royal Arms and Supporters, together with a cannon and the motto—

Ubique, quó fas et gloria ducunt.

Patterns are accordingly in preparation, and when in readiness due notice will be given to the Regiment.

(Signed) A. Dickson, Colonel,
13th July, 1832. D.-A.-General."

This attracted the attention of that eminent archæologist, the late General Sir J. H. Lefroy, F.R.S., who had received his first commission in the Royal Artillery, in 1831, at Woolwich. Sir Henry at once did me the honor of explaining that the order was blundered in its wording by a clerk, which both he and another officer of the Garrison got "put right" in the Adjutant-General's office at the time. In support, the General favored me with the following explanation in writing:—

" Penguite, Par Station,
Cornwall, 2nd November, 1885.

DEAR MURDOCH,

The General Order of 1832, to which you refer me, is no "authority." The then chief clerk in the D.-A.-G.'s office (named Campbell) at Woolwich no doubt framed it for Sir Alexander Dickson's signature, upon a communication from the Master-General, which probably covered a letter from the Herald's office or the Lord Chamberlain. If any of these could be found, or if Garter-King-at-Arms would have the original grant looked up, we should have something to go on. *Quó fas et gloria ducunt* is the motto of the 50th (West Kent Regiment), as well as of the Royal Engineers. *Ubique* is no part of the sentence, as is clearly shown by its being separated from it in the devices. The 50th enumerate twenty actions; but they cannot say with the Ordnance Corps *Ubique*! In short, it is our *Badge*—a distinct thing from our *Motto*.

Yours sincerely,

(Signed) J. H. LEFROY."

P.S.—I observe that one Regiment has *Quó fata vocant!* Everybody will see that *Ubique quó fata vocant* would be false Latin.

Sir Henry Lefroy's recollection of the incident of 50 years previously was correct; and the R.A. *Dress Regulations, 1833,* gave the Device, Badge, and Motto, as approved by the King on 31st October, 1832—subjoined:—

It may be well to give here the corrigendum order :—

"His Majesty having been pleased to grant the following Mottoes for the Royal Artillery—

Ubique,

and

Quò fas et gloria ducunt.

The word *Ubique* is to be substituted in lieu of all other terms of distinction hitherto borne on any part of the Dress or Appointments throughout the Regiment,[1] except in cases where the Royal Arms are borne in full, when the latter motto will also be inserted.

(Signed) A. Dickson, Colonel,
Woolwich, 1st June, 1833. D.-A.-General."

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Hen. III. 1216–1272	A.D. 1263	Roger de Leyburn	Suppression of Gloucester's rebellion, when "guns and other ordnance were shot into the City of London." In the 48th, Henry III., Roger de Leyburn is shown in the Exchequer Rolls—Army, Vol. I.—as exercising the functions under designation of Constable of Rochester Castle (*Constabular de Roffen*), and was the only Constable of the period who was deputed, at the national cost, to inspect the several Forts, Ballistæ, Catalpultae, ac municiones (Windsor, Rochester, Newnhaven, Odi Nore, Eckingham, Sandwich, &c., and in the North). Was present at the battle of Evesham, and throughout the war with Wales (*guerra Walliae*). The Bayeux tapestry shows the description of guns (temp. Henry III.), which are also finely depicted on the south window of the R.M. Academy, Woolwich. (The artist who took them from the Bayeux tapestry was Mr. Clutterbuck, of Stratford).
Ed. I. 1272–1307	...	Johannis le Flemyng	*Magister Ballist.* Wars of Edward I. Nothing more definitely traced beyond 23rd of Edward I.

[1] General Sir J. H. Lefroy, *F.R.S.*, who was at the time a Lieutenant R.A. in his second year of service, was so good as to jot down the following explanation of this expression:—

". . . the Badges *Leipsic*, *Niagara*, &c., worn by part of the Regiment, were ordered to be discontinued on the adoption of *Ubique*." (Initialed) J. H. L.

Note.—This *corrigendum* order was not copied into the official *MSS.* book of General Orders, and only one battalion (the 5th) preserved a copy at the time.—*R.H.M.*

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Ed. II. 1307–1327	...	Not traced.	1319. Siege of Berwick Castle, which was successfully defended by Robert Bruce (Robert de Brus), who had ENGINES (catapultae, ballistae, springaldes or springals, and bowes; but no CANNON (machinae vel Vibrelia). John Crab, a Fleming, was in command of the Engines[1] Three years later (1322) the Scotch obtained cannon by capture from the English in the battle of Leylade. *A.D. 1322.* Battle of Leylade, Northumberland, in which Ed. II. lost his ordnance, which was conveyed by the Scotch into Berwick and other fortified cities.
Ed. III. 1327–1377	...	John Pary or Parry.	1333. Battle of Halidon Hill, and capitulation of Berwick Castle. 1338. His Majesty, with his Army and Artillery, crossed over into Flanders, preparatory to invasion of France; and took into pay the Flemings—who henceforth controlled the Artillery. 1340. Siege of Ghent and Tournay. After 10 weeks assault, a truce was concluded and the army, with its great and small ordnance, withdrew to Ghent. 1346. Battle of Creçy, near Flanders—the first remarkable occasion in Europe in which gunpowder artillery was employed in the field. *Mezeray* (Rapin's *History of England*) says that "King Ed. struck terror into the French army with five or six pieces of cannon, it being the first time they had seen such thundering machines."

[1] John Barbour, Archdeacon of Aberdeen (born 1320), writing of the siege of Berwick by Ed. II. (1319), and of Robert Bruce's famous defence, gives these words on page 68 in his life of Bruce (metrical). Colonel Cleaveland, R.A. (*Memoirs*, p. 2), ascribes this event to the siege by Ed. III., when Robert Bruce was dead. (I fell into a similar error on p. 9 of "The Master-Gunner of England").

"*Jhone Crab*, a *Flemyng*, alsua had he
That was off so gret sutelté
To ordane and make apparaill
For to defend and till assaill
Castell off Wer, or than Cyté,
That nane sleyars mycht fund yn be.
He gert engyns, and cranys, ma,
And perwayit gret fyr alsua;
Sprynfalds, and schot, on fer maners
That to defend castells affers.
He purwayit intill full gret wane;
But gynnys for crakys had he nane
For in Scotland yeit than bot wene
The use of thaim had not been sane."

N.B.—As the Scotch obtained cannon three years afterwards, John Crab is thus the transition Master-Gunner who bridges the gulph between the two dispensations. "The first instructors (magistri) of Gunpowder Artillery in England were also Flemings," vide "*The Master-Gunner of England*," Vol. XIV., No. 3, "Proceedings," R.A.I.

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Ed. III. 1327–1377 *(Contd.)*	...	John Pary or Parry.	1347. Siege of Calais. "The Master-Gunner who led the English at Calais" (a Fleming) was subsequently (1386) found on board one of the French ships of war, which had also great quantities of gunpowder, guns, and engines. *At Siege of Calais.* *Staff of the Master-Gunner of England.* Gunners..... vj at 6d Artillers ..... vj per Ingyners ...lvij diem. Accordiding to original Ordinance of Ed. III., 1344. 314 { Masons. Carpenters Smiths Engineers Tent-makers Miners Gunners } at 1s. 10d. 6d. & 3d. According to *Rapin's* and *Grafton's* chronicles.
Rich. II. 1377–1399	...	Not traced.	1398. His Majesty, with a great power and artillery, embarked for Ireland and brought the greater part of that realm into good order.
Hen. IV. 1399–1413	...	,,	1400. His Majesty, with a great provision of men, munition, and artillery, marched into Wales and drove the French out of that country. 1402. Battle of Homildon. 1403. Battle of Shrewsbury. 1405. His Majesty marched with his army into the North, and with his artillery besieged Berwick. The first shot overthrew part of one of the towers, which caused the surrender. The army afterwards proceeded to Wales. 1408. Battle of Bramham Moor.
Hen. V. 1413–1422	1414	Nichol. Merburg (or de Merburg.)	*Magister Vibrellat:*—(not *Master of the Ordnance*, as rendered in Rymer's *Fœdera*). 1415. Siege of Harfleur, which the artillery so successfully breached as to cause capitulation. Four Flemish "Master-Gunners" were also of the expedition, viz., Gerald Van Willighen, Haynes Joye, Walter Stotmaker, Drovanskesall Coykyer. Battle of Agincourt, at which the above were engaged. The original (parchment) muster rolls of the army embarked this year (*Monstracio hominum ad arma armatorum et saggittariorum . . .*).[1] give the names of counts (*comes*), knights, esquires, and of some 20,000 men; but are

[1] In extended form—the original being in contractions.

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Hen. V. *(Contd.)*	1414	Nichol. Merborg (or de Merburg.)	incomplete, and do not give the ordnance muster, &c. Siege and capture of Tongue, Normandy. The artillery details comprise 1000 masons, carpenters, &c. Capture of Caen and other towns. The campaign continued through the whole winter, without interruption. Cherbourg capitulated after 3 months siege. 1419. Roen captured, and Normandy subdued. 1420 to 1422. Siege of Troyes. The Army continued in Normandy occupying the several fortresses and capturing others, and the Artillery were conspicuous in firing great stones out of great guns.
Hen. VI. 1422–1461	...	... (1)	1425. The English, in defending the town of St. Jacques de Leitson, sallied out, attacking the besiegers, and captured 14 great guns and 40 barrels of powder. 1428. Siege of Orleans, which the English army encompassed with 60 forts, of which 6 were the strongest, commanding the principal avenues to the city, and in which were placed the cannon. When the besieged perceived that they were environed with fortresses and ordnance, they laid gun against gun, and fortified towers against bulwarks, and within made new rampiers and built mud walls to avoid cracks and breaches which might by violent shot suddenly ensue. 1433. The *Master of the King's Ordnance* in this year was Gilbert Parr, who appears to have remained in the Tower of London; and in 1455, Thomas Vaughan, Esqre., held the office. 1456. The first *Master General of the Ordnance* (John Judd) was so commissioned in this year. This was the creation of the ordnance office, which was then lodged in the Cockpit, Whitehall: in 1532 the office was removed to the Tower of London.
Ed. IV. 1461-1483.	...	... (1)	1461–1471. During the civil wars of this reign, both armies were furnished with "great artillery."

[1] The appointment being for life, de Merbourg *may* have covered this period.

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Ed. IV. 1461-1483. *(Contd.)*	...	...	1474. The artillery, with artificers and laborers, accompanied the army in the expedition against France. 1482. Invasion of Scotland and capture of Berwick. One thousand men of the army were on this occasion appointed to attend the ordnance.
Richd. III. 1483-1485.	1483	Patrick de le Meyte	*Vibrellator magister. . . infra Turrim nostrum Londonii, infra regnum nostrum Angliae ac alibi. . . ;* but the Cleaveland MSS. incorrectly localise his commission to the Tower—(*vide* also note 4, p. 10 of "The Master-Gunner of England"—"Proceedings" R.A. Institution, Vol. XIV., No. 3). Raufe Bygaud was at same time appointed *Master of the Ordnance*; and the Master-Gunner of Calais (deputy or "mate" of the M.G. of E.) was Richard Warrington. 1485. Battle of Bosworth.
Hen. VII. 1485-1509.	1485	Richd. Fawconer.	1485. Sir Richard Guilsford, Knight, *Master of the Ordnance.* 1491. Sir Ed. Poynyngs, Kt., with bold soldiers and sufficient artillery embarked for Flanders; and besieged Sluys, which capitulated. The King embarked with his army and artillery for Calais and besieged Boulogne. After breaking the walls and sore defacing them with his battering pieces, peace was concluded. 1496. His Majesty, with a populous army and plenty of Artillery, marched out of the city of London for the attack of the Cornish rebels on Blackheath, whom he defeated. 1497. The Earl of Surrey, with an army and artillery, marched into Scotland in pursuit of the Scotch; besieged Haiton Castle, which surrendered in a few hours. The Earl caused his miners to raise and overthrow the fortress to the plain ground.
Hen. VIII. 1509-1547	...	...	1509. Richard Fawconer and his 12 servitour gunners petitioned the King (Henry VIII.) in the first year of his Majesty's reign for payment of their wages.

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Hen. VIII. 1509-1547 *(Contd.)*	1511	Thomas Harte (or Hart.)	1511. Sir Edward Poinyngs, Kt., with 1500 archers, and artillery commanded by Thomas Hart, Governor or Chief Gunner, embarked on an expedition to Flanders to assist the Lady Margaret, Duchess of Savoy. They besieged and won the Castle of Brionnoist, and took possession of the town of Aiske. 1512. Thomas Grey, Marquis of Dorset, embarked with an army and artillery for Spain. 1513. Sir Sampson Norton, *Master of the Ordnance.* King Henry, with an army, and the Master of the Ordnance, with the King's artillery, as fauchons, slings, bombardes, carts with powder, stones, bowes, arrows, &c. the whole No. of carriages 1300, the leaders and drivers of the same 1900 men, marched from Calais for the siege of Tourenne. On the march, by the negligence of the carters, a great curtall (called the *John Evangelist*) was overthrown into a great pond of water, also a bombarde of iron (called the *Red Gun*) overthrown into a lane. The first gun was captured by the French and carried into Boulogne; the other was recovered by the Lord Barnes, captain of the pioneers and laborers, protected by the Earl of Essex and his company. On the 14th August his majesty arrived before Tourenne, enclosing his camp with artillery, as fauchons, serpentines, cart hackbushes, and tried harrows, &c., and with his great ordnance did sore beat the walls; and Sir Alex. Buinam, a captain of miners, caused a mine to be enterprised to enter the town. *Battle of Spurs*—On the 16th of August, the *Master of the Ordnance* threw 5 bridges across the river, over which the army and great ordnance passed, and attacked with success the French army when the English artillery (culverins) came into play. The batteries having breached the walls in several places, Tourenne surrendered on the 18th. The walls and fortifications were razed, the town burned, and the ordnance sent to Aire for the King's use. On the 23rd Aug., his Majesty marched to invest Tournay: the siege commenced on 23rd, with 21 pieces of great artillery, and the town surrendered on the 29th.

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Hen. VIII. (*Contd.*)	1513	Wm. Blackenall (or Blakenal).	1513 (June). Sir Sampson Norton, *Master of the Ordnance*, and Sir Nicolas Appleyard, in September. Invasion of Scotland, and battle of Flodden. The next day (10th September) a Scotch force appearing in the field, Wm. Blackenall, who had the chief rule of the British ordnance, caused such a peal to be shot off at them that the Scots fled. Two-and-twenty pieces of ordnance were taken; amongst them seven culverins of large assize, called by King James the "seven sisters." [1] The *Master-Gunner* of the English part opened his fire, slew the *Master-Gunner of Scotland* and beat all his men from their ordnance—so that the Scotch ordnance did no harm to the English, but the English artillery shot into the midst of the King's battle and slew many persons.
	1523	Christopher Morris *(Knighted in 1537.)*	1523. Sir Wm. Skevington, *Master of the Ordnance, 6th July.* The Earl of Surrey, with an army, and artillery commanded by the Master of the King's Ordnance, having landed the Emperor in Biscay, returned with his fleet and made a descent on the coast of France, near Morlies, marching thither and assaulting the town, won it—for the *Master-Gunner*, Christopher Morris, having there certain falcons, with the shot of one of them struck the lock of the wicket in the gate, so that it flew open, and then the same Christopher Morris and other gentlemen, with their soldiers, in the smoke of the guns, pressed to the gates, and, finding the wicket open, entered, and so finally was the town of Morlies won and put to sack. The army shortly after returned to England.

[1] "They saw, slow rolling on the plain
Full many a baggage, cart and wain,
And dire artillery's clumsy car
By sluggish oxen tugged to war.
And there were Borthwick's *sisters seven*,
And culverins which France had given.
Ill omen'd gift! the guns remain
The conqueror's spoil on Flodden's plain."

Marmion, Canto IV., Div. 27.

The following extract will give an idea of the value of pieces of artillery at this period:—"The King (James V.) went in person against it (Tantallon Castle), and for its reduction borrowed from the Castle of Dunbar, then belonging to the Duke of Albany, two great cannons whose names were *Thracon-mouthed-Mow, and-her-Marrow*; also two great botcards and two moyans, two double-falcons, and four quarter-falcons, for the safe guiding and re-delivery of which three lords were laid in pawn at Dunbar."—*Marmion*. Note 15 to Canto V.

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Hen. VIII. *(Contd.)*	1523	Christopher Morris (*Knighted in 1537*).	*23rd August.* Admiral Sir Wm. Fitz William, with his fleet, soldiers, and field artillery under the *Master-Gunner*, Christopher Morris, sailed for the French coast and landed near Treyport: after severe fighting they re-embarked, after burning seven fine ships, destroying their bulwarks and capturing 27 pieces of ordnance, *1524.* Siege and capture of Calais. The first enterprise was the winning the castle, called Belle Castle, by the power of battery; and Sir Wm. Skevington was directed to raze it to the ground. Siege and capture of Bray, by assault after five hours battery with the ordnance. Capture of Mondelier: after four hours battering the walls were overthrown and made assaultable, then the garrison surrendered. Siege of Boghan Castle, wherein were found 76 pieces of artillery, as bombardes, curtaux, demi-curtaux, slings, cannon, volgers, and other ordnance. 1530. Pacification of Kildare. 1532. Removal of the *Ordnance Office*, under the Master of the King's Ordnance (Sir Wm. Skevington) to the "Bryck Tower" of the Tower of London.[1] 1537. In this year the *Master-Gunner of England* was appointed, also *Master of the Ordnance*, and continued to be so described until 1544, when he was *Lieutenant* at 10s. a-day, with Sir Thomas Seymour as *Master* of the Ordnance at £1 6s. 8d. per diem. Sir Christopher Morris appears to have retained the *Master-Gunnership of England*[2] in addition to his other functions—for according to Stowe's *Surrey*, folio 196, page 211, *art.* "Morrice," Sir C. Morris was interred in St. Peter's Church, Cornhill, by the title of "Master-Gunner of England to Henry VIII." To the many laws, ordinances, and regulations issued for the support of archery may be added the institution of the Artillery Company, which was incorporated by the Patent of Henry VIII., in the year 1537, to Sir

[1] This is what Sir Philip Hoby (*Harlean MSS.* 623) refers to as the "incorporation" of the office of the ordnance by Henry VIII., but it will be observed that the office itself was created A.D. 1456 by Henry VI.

[2] *Kane's List*, p. 151, is incorrect in describing Sir C. Morris as *Lt.-General of the Ordnance.*

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Hen. VIII. (*Contd.*)	1523	Christopher Morris *(Knighted in 1537.)*	C. Morris, Knight, Master of the Ordnance, Anthony Knevot, and Peter Mawtes, Gentlemen of the Privy Chamber, Overseers of the fraternity or guild of St. George, granting licence to them to be overseers of the science of Artillery, viz., for long bows, cross-bows, and hand guns; and the said Sir C. Morris, Cornelys Johnson, Anthony Anthony, and Henry Johnson, to be masters and rulers of the said science of artillery during their lives, &c. 1544. The Earl of Hertford, with an army, and artillery commanded by Sir C. Morris, embarked for Scotland—landing near Leith, which they immediately captured. The army then marched towards Edinburgh, when Sir C. Morris, with his gunners and ordnance, beat the Scots from their ordnance and opened the Canongate with the shot of their great ordnance. The King, with an army, passed over to Boulogne, in this year, where Sir C. Morris with his great artillery and mortar pieces so battered the walls, from three several places, that there were very few houses left; the breaches being practicable, the assault was made by the Lord Admiral Dudley, under the protection of the artillery, which kept up a continual fire on the breach during the advance. After a severe conflict the assailants were recalled, shortly after which the Governor capitulated. Sir C. Morris was wounded at the siege, and appears to have died shortly afterwards—as Sir Thomas Wiat or Wyatt was appointed *Lieutenant of the Ordnance* in 1546. With this expedition two companies of the artillery train (100 gunners each) embarked, each commanded by a *Master-Gunner* (Burmadyne de Vallowayes and John Basset, each at 4s. per diem, or double pay).
Edward VI. 1547–1553	1546 or 1547	Christopher Cowld (or Gould.)	Named in the Royal Warrant of Queen Elizabeth (given in full in "Proceedings" R.A. Institution, Vol. XIV., No. 3). His pay is therein prescribed as 2s. per diem, with allowances, &c.—not 1s. as stated in the Cleaveland MSS., p. 14. (This was the rate of pay enjoyed by Members of Parliament at

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Edward VI. *(Contd.)*	1546 or 1547	Christopher Cowld (or Gould.)	the time). The pay and allowances, during peace, appear to have been equivalent to about £190 per annum. (Sir Francis Flemynge, Kt., was *Master of the Ordnance* at this time; and in 1548 was succeeded by Sir Philip Hobey). Rebellion in Norfolk quelled (1549) by the Earl of Warwick's army and artillery.
Queen Mary 1553–1558	1553 to 1570	Richard Webb.	1553. Richard Webb, *Master-Gunner of England*. Sir Edward Blair, *Master of the Ordnance*. The latter was replaced in 1555 by Sir Richard Southwell. 1557. The Lord Robert Dudley, Earl of Leicester, appointed *Master of the Ordnance*, and with the *Master-Gunner of England* embarked for the Netherlands with the army and artillery of the Earl of Pembroke to join the Spanish army commanded by the Duke of Savoy, taking part in the siege of St. Quintins. 1558. The *Master-Gunner of Calais*, named Horslie, was killed in defending the bridge (against the French). Sir W. Pelham, *Master of the Ordnance*. 1559. Earl of Warwick, *Master-General of the Ordnance*, with Sir Wm. Pelham as his Lieutenant.
Queen Elizabeth. 1558-1603	1570	Anthony Fenrutter.	Fenrutter had served as a *Gunner* and as a *Master-Gunner* under Edward VI. and Queen Mary—vide also *The Master-Gunner of England*, "Proceedings," R.A.I., Vol. XIV., No. 3. The Cleaveland MSS. are incorrect in stating (on authority of *Hollinshead*) that the Robert Thomas, who was killed in 1565, was *Master-Gunner of England*. The Royal Warrant of 13th, Queen Elizabeth, recapitulates the *Master-Gunners of England* since Ed. VI. as successively—Christopher Gould, Richard Webb, and Anthony Fenrutter.
...	1578	Stephen Bull	1578. Pay of the *Master-Gunner of England* recorded as £66 13s. 4d. *per annum.* (Eliz. *codice* MSS.); but the Royal Warrant prescribed 2s. *per diem.* and allowances—*vide* "Proceedings" R.A. Institution, Vol. XIV., No. 3.

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Queen Elizabeth *(Contd.)*	1578	Stephen Bull	Had served as a *Gunner* and *Master-Gunner* under Henry VIII., Mary, and Edward VI., by sea and land, which services, together with his inventions in gunnery and fireworks, are the grounds assigned for his preferment as *Master-Gunner of England* for life, with reversion to his sons, entail. The "Bull" family appear to have degenerated into manufacturers and supervisors of artillery drill, and as *Master-Gunners of England* did not take the field. A *Colonel of Artillery* (Christopher Blount) first appointed in 1597.
...	1589	Stephen Bull (junr.)	Joint *Master-Gunner of England* with his father since 1578. Had served as a *Gunner* and *Master-Gunner* since 1561. Appointment of *Master-General of the Ordnance* put into commission until 1596. In 1596 there were—Master-General of the Ordnance, Earl of Essex; Lieut.-General of the Ordnance, Sir Robert Constable; Lieut. of the Ordnance, Sir George Carew; Colonel of the Artillery, Sir Christopher Blount. 1598. Surveyor-General of the Ordnance, Jno. Davis (Knighted in 1599). 1603. Charles Blount, Earl of Devon, appointed *Master-General, vice* Earl of Essex (who had been suspended) since 1600.
James I. 1603–1625	1611	William Hammond.	1608. Lord Carew (afterwards Earl of Totness) appointed *Master-General.* 1618. A *General of Artillery* first named. PRIVY COUNCIL. At Whitehall, 4th July, 1620. "Whereas the Tower of London being his Majesty's royal castle, one of the principal and most eminent forts of this kingdom, a great strength and ornament to the city, the chief storehouse and magazine of warlike provisions of this kingdom, hath antiently been fortified, not only within the walls, ditches and wharfs of the same, but also such care taken in the minorits (the minories) and other neighboring places, as well for the lodging and receipt of the principal officers of the Ordnance, as likewise for artificers, gunmakers,

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
James I. *(Contd.)*			wheelers and others, whose trades are appropriated to military ends, as nothing was there almost wanting, which was fit for the State to provide, either for honor or safety. But for as much in these latter times, either through the evil example or tolleration of some lieutenants of the Tower, or by abusing of trust reposed in some officers who have particular relation to the place, there hath insensibly crept in diverse abuse and incroachments, whereby the said antient limits of the Tower and those other habitations and storehouses, appointed for public use, are now perverted to private profit, the splender and magnificence of the said Royal Castle being by that means defaced, and the place itself as it were besieged in the wharf, ditches, and liberties thereof. Upon complaint made of all which abuse the Board ordered as follows :—That whereas there was a lease procured from His Majesty to *William Hammond, Master-Gunner of England* in the Tower, of the Artillery yard near unto the minorits, and an antient obsolete name of the tifal yard, for 223 years, and the same lease being defective and apparently void, and so acknowledged by the same *Hammond* and his councel for manifest imperfections found out by the said Sir Edward Cooke, was by the said *Hammond* delivered into the hands of the said Sir Ed. Cooke, and now remains in the Councel's chest. It is ordered that the said Artillery yard be for the future restored to the public use for which it had been formerly employed, viz. :—for exercise of arms and artillery, and that the same shall not henceforth be alienated or converted to any other use . . . ."

(To be continued.)

STEEL AS APPLIED TO ARMOUR.

BY

LIEUTENANT J. H. MANSELL, R.A.

As an introduction to the consideration of what we want in an ideal armour-plate, we will consider how wrought, and cast-iron armour, respectively, resist the attack of projectiles.

Wrought-iron, when struck by a projectile, yields locally and destroys the energy of the blow in the act of its own destruction. It is perforated by the projectile in a greater or less degree, and the protection afforded by it depends on whether the energy of the projectile is destroyed before the armour is completely perforated.

None of the shock of impact is transferred into its mass, and obviously, as the ballistics, etc., of guns improved, so must the thickness of the wrought-iron protection against their fire be increased. The question of weight alone would determine a maximum thickness in the case of ships of war.

On the other hand, wrought-iron, however hard it is struck, does not crack, all the damage being confined to the immediate vicinity of the point of impact.

Cast-iron has never yet been perforated to any appreciable extent, only slight gouges in it being formed.

As compared with wrought-iron it is hard. The cast-iron stands up to the shell and breaks it up or deflects it, but the shell cannot get through. The shock of the blow it transfers through its mass, and we therefore find cast-iron developing cracks at a distance from the point of impact. Cast-iron is, however, unsuited for the protection of ships, though it has been applied to some forts on the Continent, notably at Spezia and near Antwerp. Here, then, we have two extreme cases :—Wrought-iron is soft and ductile, it suffers a maximum amount of injury at the point of impact, and a minimum in its mass. Cast-iron is hard and brittle, it suffers a minimum amount of injury at the point of impact, and a maximum in its mass. To compare these two forms of resistances :—Obviously a system in which resistance is only offered in the act of self-destruction is unsatisfactory, but there is more than this to be said in favour of the hard surface of cast-iron. An ogival-headed projectile, when it first strikes a plate, is in the position of greatest disadvantage as regards its own resistance to breaking up or deformation. As it gets its nose into the plate, the plate itself surrounds and supports the walls of the projectile, and assists it in its work of destruction. And in addition, if a projectile is broken up at the instant of striking, it has not time to impress all

its energy on the plate; the smaller pieces scatter themselves about the face of the plate, and so much of the energy is frittered away. A hard plate that will break up the shell at the moment of striking appears, therefore, to be the desideratum. But intimately allied with hardness we find brittleness—as indicated by the cracking of the cast-iron—and if these cracks are serious, or developed by continuous firing, the armour will fall off in large flakes and leave the structure we wish to protect bared to the fire of the enemy; as noticed, with wrought-iron such a result would not be possible, and our object must be then to find an alloy that will combine, as far as possible, the ductility of wrought-iron with the hardness of cast.

Such an alloy is steel.

By attention to its chemical constitution, combined with certain mechanical measures, which will be noticed presently, steel can be made either to approach wrought-iron or cast-iron in these special properties of extreme hardness or ductility. Intermediate between these two we find steel combining, in a greater or less degree, both these properties, *i.e.*, a steel which approaches cast-iron in hardness, and yet possesses some of the ductility of wrought-iron.

But if our armour-plate is made all through of one sort of steel, we should expect to find it either too soft, and therefore yielding to perforation; or else, if hard, too brittle.

It therefore seems as if the ideal armour-plate, if made of steel, should have a hard face that will stand up to and break the projectile at the moment of impact, *supported* by a softer steel foundation, that will assist the hard surface to resist the shock through its mass, and so prevent the cracking and peeling off.

Having thus considered the problem for the steel-maker, a glance at some of the principal properties of steel may prove of interest, before passing on to an indication of some of the methods that have been tried for its solution, followed by a brief notice of some recent armour-plate trials, for which I am indebted to *The Engineer* and *Engineering*.

Steel for our purpose may be considered as an alloy of iron, with carbon, silicon, manganese, sulphur, etc., some of which elements it is the object of the steel-maker to get rid of, whilst others he introduces in certain proportions, and by certain methods, to attain certain ends.

Phosphorous and sulphur are his two chief enemies, and with these we will not concern ourselves, being content to know that their injurious effect is minimised by their nearly complete removal.

Carbon, we may say, is the element whose effect we have chiefly to consider. When it is present in only small proportions, such as 0·1 per cent., the steel is soft and assimilates to wrought-iron: the higher percentage of carbon there is the harder is the steel, and the more nearly it assimilates to cast-iron in its properties. The method of introducing it in the various amounts is outside the limits or objects of this letter in which, I suppose we have satisfactorily produced our steel and are only considering its after treatment. Carbon, then, is an element of great importance, and we shall see how it has recently been introduced in larger quantities to get the hard-face plate. Silicon

and manganese are both most important elements, but do not appear to so directly affect the question we are dealing with, that is to say, the attainment of the hard face to a plate, though their presence in proper proportions is essential to get good steel plates. Manganese and carbon together, being added in fact, to all furnace charges before tapping, in the form of spiegeleisen, or ferromanganese, etc.

Nickel, we have lately heard a good deal of as being capable of imparting special resisting properties to steel, into which it is introduced in proper proportions—though its introduction has not been attended with that success on this side of the Atlantic which is reported from America. It appears to toughen steel, but "nickel steel" plates have been various in their behaviour, the correct method of alloying it not appearing to be entirely understood as yet. Steel possesses the following property: if it be heated up to a high temperature, and then suddenly cooled by plunging it into liquid, such as oil, it is "hardened"—its breaking strain and limit of elasticity are raised, but, as might be expected, its ductility is lessened; but if the steel is now heated up again to a temperature below that at which it was hardened and allowed to cool slowly, its ductility is in a great measure restored, and at the same time its breaking strain and elastic limit are lowered but little.

If we examine the fracture of steel in the "soft" state, we find it is composed of a group of fair-sized crystals, but after hardening, the appearance of the fracture is much finer and closer and the crystals much smaller; in fact in very hard tool steel it is hard to distinguish them.

It would seem as if, when the steel is heated, these crystals dispose themselves in certain ways, or the crystalline form is lost entirely, and the rapid chilling re-crystallises the steel so suddenly that only small crystals have time to form, and at the same time they are all thrown into a state of tension one with the other. By subsequent heating and slow cooling the crystals are enabled to dispose and settle themselves comfortably, while at the same time the size of them is affected but little, if at all, the ductility is thus in a great measure restored, and it would appear as if the hardness depends to a certain extent on the size of the crystals in a particular steel, and this is but little affected by "annealing" at a suitable temperature. The higher the proportion of carbon, the lower is the temperature to which it is requisite to heat the steel in order to harden it, and for each steel there is a particular temperature of hardening, heating above which does harm. The lower temperature to which it is necessary to heat a high carbon steel in order to harden it, is due to the amount of carbon present, and has its analogy in the fact that cast-iron, which is iron in the maximum degree of carburization, melts at 2786° F., while wrought-iron, which has the smallest amount of carbon alloyed with it, will not become truly liquid at any ordinary furnace temperature. Wrought-iron is usually termed in text-books "the fibrous form of iron," and this is true so far as it goes, though steel undoubtedly can have its crystals arranged by forging, so as to show some of the characteristics peculiar to a line of fibre running through a mass of wrought-iron.

Properly directed forging and rolling (its half-brother) improve the quality of the steel immensely, and steel for plates is always so treated, except in the case of the steel junction[1] of Ellis compound plates.

This forging is much more economically and effectively performed now, by hydraulic presses, in the place of steam hammers. More economically, for the same end can be attained roughly in one-third the number of heats, and so the extra expense of fuel for heating is saved, as also all the attendant risks in re-heating: and more effectively, because the shock of the steam hammer is not transferred to the interior of a large mass, but is absorbed by the outside layers, while the steady pressure of the hydraulic press penetrates to the interior of the largest masses dealt with for armour-plates, and so does its good work all through.

Steel also possesses the property, while in the fluid state, of occluding or absorbing within its mass certain gases, such as nitrogen and oxygen. On cooling, these gases try to escape, but the outer layer of steel having cooled first they are imprisoned, and so press up the steel at the top of a casting and make unsound metal, full of blow-holes. For this reason steel ingots are cast with "heads," in which the unsound part may be concentrated, and these heads are cut off. A certain amount of these gases remains in the casting, but forging expels most of them. It is for this reason that I think the "compound" system of Messrs. Brown, on the Ellis patent, is open to objection if for no other. It does not seem as if there are sufficient arrangements made to get this head to the steel they pour in to effect the junction between their hard-face plate and wrought-iron foundation—as a consequence, frequently, on fracture, this steel junction shows signs of unsoundness, and in such a state must be unreliable as a support to the front plate. In addition, is the risk of "burning" either the steel of the face-plate or the wrought-iron of the foundation which must be incurred by such a process, though some recent plates of theirs, "Tressiderized," have given most excellent results, as will be noticed.

Steel armour can be divided into two broad classes:—Armour in which there is a hard-face plate, supported by a softer foundation; and the so-called all-steel armour, in which the quality of the steel is the same all through. As I have said, to me it seems that success in the future lies in the direction of the hard face, supported by the softer back, but all steel recently gained a victory at Ochta, St. Petersburg, as reported by Captain Talbot in this journal. The success of these plates was solely due to the general excellence of the steel of which they were made, and Messrs. Vickers doubtless attained this excellence by attention to the various points in its treatment which have been indicated above. As one would expect in a plate of this class, they were soft, and such was the official opinion. But though they did yield to perforation, it was in a minor degree; and their superiority over their competitors was marked enough to gain for them the Russian order.

Turning to the other class we find two sub-divisions.

Plates which are made in one, and of one sort of steel all through,

[1] This is only rolled.

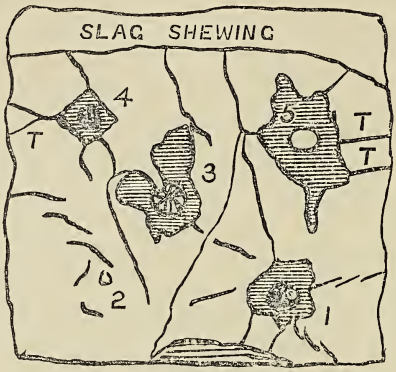
the hard face on which, is got by special treatment of only that part of the plate, and the so-called compound plates, on the Ellis and Wilson patents. The Ellis plates, as made at Messrs. Brown's, consist of a hard high carbon steel plate, welded to a foundation plate (previously prepared) of wrought-iron by pouring molten steel, lower in carbon and therefore softer, than the face-plate, in between the two ; the whole then being subjected to pressure by which the union is effected.

I do not propose to notice any trials with plates on the Wilson patent, which is somewhat similar to the Ellis. Plates on the Ellis patent, as treated by a process invented by Captain Tressider, C.M.G. (late R.E.), of the firm of Messrs. J. Brown & Co., have recently been remarkably successful. The process by which these plates are "Tressiderized" is not yet public, but it is reported by some that it resembles the "Harveyizing" process, described presently. This, I think, is more than doubtful, for it would seem that if this was the process it would be attended with less risk to the plate if the hard-face plate was so treated before being united to its back—and, I understand, whatever the process is, it takes place on the complete "compound" plate.

There are two ways that have been tried of getting a hard face on to what we will now call an all-steel plate. One is to heat up the plate and dip it to only a certain depth in oil, and thus harden the face. A plate so treated was taken by Schneider to Spezia in 1886, but it had warped very much. There does not seem to be any means of stopping this warping in this process; and though an isolated plate may stand its trial, a process which causes such malformations is, of course, inadmissible on the large scale. The most recent process is one proposed by a Mr. Harvey in the United States. In principle it is old, having been known for many years in Sheffield under the names of "case hardening" and "cementation." It differs from these slightly, however, in its mode of effecting the desired result. A mild steel plate is covered with granular carbonaceous material well rammed down, and then placed in a fire-brick cell; this cell being then placed in a suitable furnace, the heat is raised to something over 2000°, which takes about two days. This heat is then maintained for about five days for a 10·5-inch plate ; the plate is then withdrawn and allowed to cool, covered with its carbonaceous material to prevent oxidation by the air. By these means the amount of carbon in the steel is increased by about one per cent. at the surface, the increase dying away as we get deeper into the plate. When the plate has cooled to a dull cherry red, or say about 1100°—1200°, it is suddenly chilled by a spray, and so further hardened. Special precautions are taken to prevent warping, and I understand there is every promise of these precautions being eventually successful, though there is no definite information on this point yet. We will, now, briefly notice trials of a "Tressiderized" and a "Harveyized" plate.

Trial of a Tressiderized plate at Shoeburyness on July, 23rd, 1891. This was a 7′ 6″ × 7′ 6″ × 10·5″ plate. It was slightly warped by treatment, the face being convex. This was bolted to four feet of oak backing, the space between plate and backing, where former had

warped, being filled in with Portland cement. The plate was not a finished one, but was the rough top end cut off another. The 6-inch B.L. gun was used; charge 48 lbs. of E. X. E. powder. Subjoined is a sketch of the plate, and a tabulated list of rounds fired.



Cracks marked "T" appeared at the back of the plate near the edge.

Round.	Projectile.	Striking velocity. f.s.	Energy ft. tons.
1	Hadfield forged steel.	1949	2634
2	Palliser.	1929	2579
3	Hadfield.	1909	2527
4	Palliser.	1939	2607
5	Hadfield.	1937	2603

This may truly be called a remarkable plate. No shot got through except Round 5, and it was originally intended only to fire three rounds at the plate, so much of it being what is usually cut off as waste. It stood the first three rounds so well though, that the two others were fired.

Round 1.—The shell broke up; the penetration being slight, and only a few cracks being formed.

Round 2.—The Palliser shot was shivered, and splashed on the face; the indentation being only ·85 inch.

Round 3.—This shell also broke up, but rather a larger piece of steel was splintered out towards the slag end of the plate.

Round 4.—The shell broke, leaving its head in the plate and an indent of two inches; one crack made by this round was through at the edge.

Round 5.—The shell got through the plate, and two of the cracks made by it were through at the edge.

This plate then stood a remarkable trial, and, spite of one's objections to the system by which the hard face is joined to the back, it must be a subject for congratulation that an English firm have succeeded in making such a plate.

Against this plate the best forged steel projectiles flew to pieces, the hard face breaking them up, and so they delivered only a portion of their energy into the plate. The warping of the plate here noticed is serious, but Messrs. Brown state that they can obviate this entirely, and also hope that they will be able to apply the process successfully to curved plates.

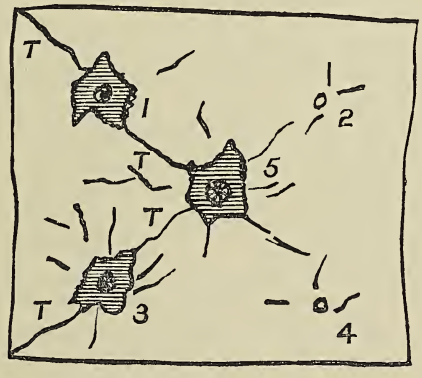
Another trial of these plates took place afterwards at Portsmouth, when they were equally successful, breaking up all the projectiles, and the greatest bulge at the back of the plate being only 0·9 inches.

This plate appears not to have been warped at all : its size was 8′ × 6′ × 10·5″.

Now to turn to the trial of a "Harveyised" plate, carried out at India Head, United States, on November 14th, 1891. This plate was of nickel steel, the carbon being 0·31 per cent. and nickel 3·07. The dimensions of the plate were 8′ × 6′ × 10·5.″ The four first rounds were fired from the 6-inch B.L. high-powered rifle ; the projectiles were Holtzer armour-piercing shells, weighing 100 lbs., the striking velocity was 2075 f.s.

The fifth round was fired at centre of plate from an 8-inch B.L. high-powered rifle, with a steel shell, hardened by the Firminay process, weighing 210 lbs., and striking with a velocity of 1850 f.s.

The annexed sketch is only to give a rough idea of the Harvey plate and is in no way official, but is intended to assist the description of the trial.



Cracks marked "T" are through.

Round 1.—The shell was broken into a great many pieces, the point fragment being about the size of a small flat peg-top. The penetration was about 12 inches ; there being a considerable amount of chipping round the hole, with no bulge.

Round 2.—The shell broke into so many small fragments that only

a portion of them could be recovered: 6·8 inches of the point of the shell remained so embedded in the plate that shell and plate seemed welded together. The penetration could only be estimated and was judged to be about five inches.

Round 3.—The shell rebounded uninjured close to the muzzle of the gun. The penetration was 12¼ inches, and there were several fine radial cracks.

Round 4.—The shell was shattered into many fragments; estimated penetration five inches. The ogive of the shell remained embedded in the plate, as in Round 2, which this much resembles, and only a saucer-like depression appeared in the face of the plate.

Round 5.—With the 8-inch gun, the shell rebounded about 40 feet, slightly set up, and scaled; penetration 12⅞ inches. Two very deep cracks were made on left side of plate; one ran from the centre upwards, through the hole made by Round 1, and the other ran similarly down to the left, through the hole made by Round 3; the plate was, therefore, divided into two parts, though the bolts held it in position.

This plate then stood this most several trial in a highly satisfactory manner.

It is hard to compare the results of this trial with that of the "Tressiderized" plate at Shoeburyness.

The Harvey plate was more severely tried than the Tressider one, and in addition, only steel shell were fired against it, and though if a shell breaks up on impact it may not make much difference what sort of a shell it is, it seems probable that a steel shell would hold together slightly longer and impress more of its energy, than a Palliser, before breaking up.

On the other hand, the Tressider plate showed only a little through cracking, and was not a finished plate, yet it must be borne in mind no 8-inch shell was fired against it, which was the round that cracked the Harvey plate.

The Harvey plate was certainly very severe on the projectiles, and it looks as if the proper left of the plate was better treated than the right. This may be due to variations of temperature in the furnace, whereby one part would absorb more carbon than the other, and also would possibly be hardened more by the spray on account of being slightly hotter, supposing the plate to have cooled regularly. I think the results of these two trials show armour has lately advanced a step in the direction of the ideal plate. The "Tressiderized" plate certainly seems to come nearer to the ideal, but we have yet to see how it will behave under a more severe trial, such as that which the Harvey plate experienced. It is possible that when the plate is over-matched and does not succeed in breaking up the projectile so quickly, some unexpected weakness may show itself, but this, of course, only actual trial can determine. In armour-plate trials it is especially true that it is the unexpected that happens, but at present these trials give every promise of plates being produced which will give results hitherto unattainable.

SHEFFIELD,
December 4th, 1891.

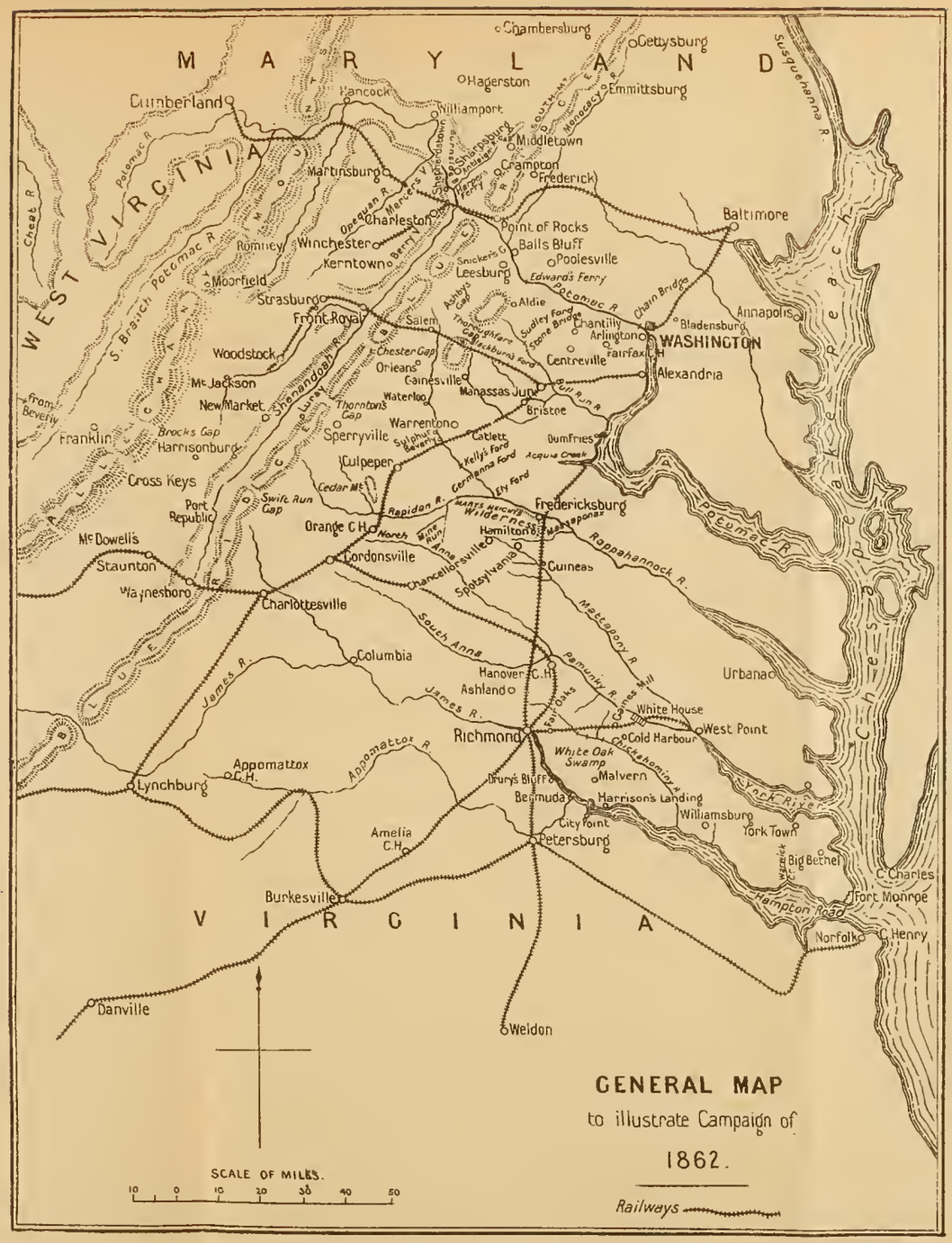
ACTIONS IN VIRGINIA.

1861.

Big Bethel	*June* 10.
Rich Mt. and Beverley in West Virginia	*June* 11 *and* 13.
Blackburn's Ford	*July* 18.
Bull Run	*July* 21.
McClellan organizes a New Army—	*August*, 1861–*March*, 1862.
Ball's Bluff, near Leesburg	*Oct.* 21.

1862.

The Monitor v. Merrimac in Hampton Roads	*March.*
Confederates evacuate their Works on the Bull Run	*March.*
McClellan at Fort Monroe	*April* 4.
York Town surrenders	*May* 3.
Williamsburg	*May* 5.
Norfolk surrenders. Merrimac burned	*May* 5.
Hanover Court House taken	*May* 27.
Battle of Fair Oaks	*May* 31–*June* 1.
Jackson in the Shenandoah Valley	*May* 8–*June* 9.
McDowell	*May* 8.
Front Royal	*May* 23.
Newtown	*May* 24.
Winchester	*May* 25.
Cross Keys	*June* 8.
Port Republic	*June* 9.
McClellan and Porter on the Chickahominy, and retreat to the James	*June* 25–*July* 2.
Beaver Dam Creek	*June* 26.
Gaines Mill	*June* 27.
Savage Station	*June* 29.
Glendale	*June* 30.
Malvern. Harrison's Landing reached	*July* 1.
Pope in Command North of the Rapidan	*July* 14.
Cedar Mt.	*Aug.* 9.
McClellan retires from Harrison's Landing	*Aug.* 16.



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1862.

Jackson turns the flank of Pope's Army	*Aug.* 25–*Sept.* 2.
Bristoe	*Aug.* 26.
Gainesville	*Aug.* 28.
Groveton	*Aug.* 29.
Bull Run	*Aug.* 30.
Chantilly	*Sept.* 1.
McClellan saves Washington	*Sept.* 4.
Confederates invade Maryland	*Sept.* 5–*Sept.* 22.
Sharpsburg (on the Antietam)	*Sept.* 17.
Confederates retire to Virginia	*Sept* 22.
Stuart's raid into Pennsylvania	*Oct.* 10–*Oct.* 13.
Battles of Fredericksburg	*Dec.* 10–*Dec.* 15.

1863.

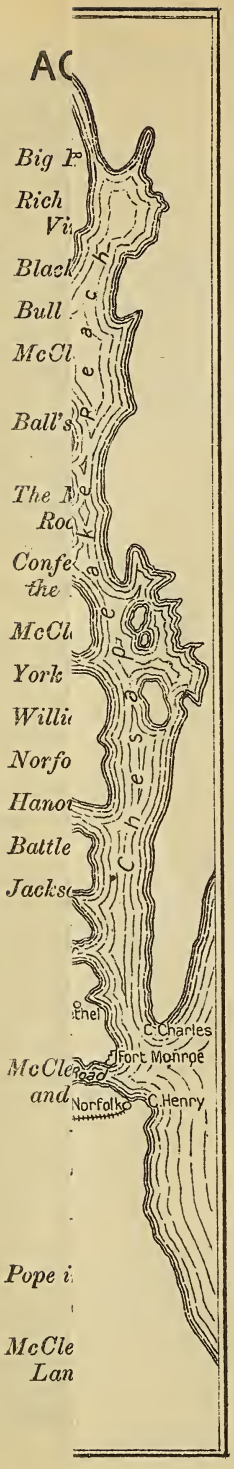
Battle of Chancellorsville	*April* 28–*May* 5.
Lee invades Maryland and Pennsylvania—	*June* 14–*July* 14.
Gettysburg	*July* 1, 2. 3.
Mine Run	*Nov.* 27–*Dec.* 1.

1864.

Kilpatrick and Dahlgren's raid	*Feb.* 27–*March* 4.
General J. Stuart killed	*May* 11.
Grant crosses the Rapidan	*May* 1.
Battle of the Wilderness	*May* 5, 6.
Spotsylvania	*May* 10, 12.
Series of flank marches by Grant to the Peninsula and thence to Petersburg	*May* 12 *June* 15.
Grant defeated at Petersburg	*June* 18.
Early's raid to near Washington	*July* 9–*July* 13.
Raid on Chambersburg	*July* 30.
Great mine exploded at Petersburg	*July* 30.
Sheridan ruins the Shenandoah Valley	*Aug.*–*Oct.*
Battle of Winchester	*Sept.* 19.
Battle of Cedar Creek	*Oct.* 19.

1865.

Five Forks	*March* 31–*April* 2.
Richmond and Petersburg evacuated	*April* 2, 3.
Lee's surrender at Appomatox Court House	*April* 9.
Johnston's surrender	*April* 26.



1862.

Jackson turns the flank of Pope's Army .. .. .. *Aug.* 25–*Sept.* 2.

Bristoe .. .. .. *Aug.* 26.
Gainesville .. .. .. *Aug.* 28.
Groveton .. .. .. *Aug.* 29.
Bull Run .. .. .. *Aug.* 30.
Chantilly .. .. .. *Sept.* 1.

McClellan saves Washington .. *Sept.* 4.

Confederates invade Maryland *Sept.* 5–*Sept.* 22.

Sharpsburg (on the Antietam) .. *Sept.* 17.

Confederates retire to Virginia .. *Sept* 22.

Stuart's raid into Pennsylvania *Oct.* 10–*Oct.* 13.

Battles of Fredericksburg .. *Dec.* 10–*Dec.* 15.

1863.

Battle of Chancellorsville .. *April* 28–*May* 5.

Lee invades Maryland and Pennsylvania— *June* 14–*July* 14.

Gettysburg .. .. .. *July* 1, 2. 3.

Mine Run .. .. .. *Nov.* 27–*Dec.* 1.

1864.

Kilpatrick and Dahlgren's raid *Feb.* 27–*March* 4.

General J. Stuart killed .. .. *May* 11.

Grant crosses the Rapidan .. .. *May* 1.

Battle of the Wilderness .. .. *May* 5, 6.

Spotsylvania .. .. .. *May* 10, 12.

Series of flank marches by Grant to the Peninsula and thence to Petersburg .. .. .. *May* 12–*June* 15.

Grant defeated at Petersburg .. *June* 18.

Early's raid to near Washington *July* 9–*July* 13.

Raid on Chambersburg .. .. *July* 30.

Great mine exploded at Petersburg .. *July* 30.

Sheridan ruins the Shenandoah Valley *Aug.*–*Oct.*

Battle of Winchester .. .. *Sept.* 19.
Battle of Cedar Creek .. .. *Oct.* 19.

1865.

Five Forks .. .. .. *March* 31–*April* 2.

Richmond and Petersburg evacuated *April* 2, 3.

Lee's surrender at Appomatox Court House . .. . *April* 9.

Johnston's surrender .. .. .. *April* 26.

THE OPERATIONS IN VIRGINIA,

1861-65.

BY

T. M. MAGUIRE, LL.D.

(*Of the Inner Temple, Barrister-at-Law*).

(*A Lecture delivered at the Royal Artillery Institution, Woolwich, 23rd November*, 1891).*

LT.-COLONEL C. H. SPRAGGE, R.A., IN THE CHAIR.

COLONEL SPRAGGE AND GENTLEMEN,

The most a lecturer can do, when asked to discuss a subject so vast as that selected, is to content himself with an attempt to set forth the general ideas upon which the several operations were based and the outlines of the manœuvres. To enter into details would be both useless and perplexing.

Before an audience such as this, I need not discuss, at any length, the origin of the great American Civil War. Many causes of discontent, but particularly the anti-slavery views of the Northern States, alienated the minds of the people of the Southern States from the union. Once Mr. Lincoln was elected president, preparations for secession commenced in many States. It was no longer a question of negro slavery or emancipation ; Carolina first, and then ten other States, asserted the right of detaching themselves from the central government at will, and formed a new confederacy with a capital at Richmond in Virginia. Some States wished to be neutral, but had the usual fate of "weaker natures" between the "fell strokes of mighty opposites ;" the other States were true to the old federal government at Washington, and adhered, at all costs, and, with no regard to mere abstract theories, to Mr. Lincoln's resolve that the mightiest of republics should, even as the most absolute of monarchies, be one and indivisible.†

When Major Anderson, who commanded for the government in Fort Sumter at Charleston, was obliged to surrender to General Beauregard and the Carolina State troops, April 13th, civil war began.

Many of the best officers of the old regular army were of opinion that

* This lecture was delivered *ex tempore* and profusely illustrated by notes on the blackboard during delivery ; so that this is merely a general sketch of the lecture.—*A.J.A.*

† The names of the several States are given in the appendix.

their allegiance was due, not to the common country, but to the individual State. It is not my duty to enter into the complicated questions of constitutional policy upon which this opinion was based. Mr. Jefferson Davis, the Confederate president, no doubt, like Mr. Lincoln, the Federal president, believed the quarrel just, and most assuredly Generals Lee, Joseph Johnson, Beauregard, and J. E. B. Stuart, had attained the highest strains of honour, and sacrificed their all to what they honestly believed their duty. Thomas Jackson's proceedings became an eccentric man and a strong religious enthusiast of the puritan type ; he was undecided ; his father-in-law was a Federal ; a consultation was held ; prayer was resorted to ; the father-in-law was earnest and eloquent ; but, when the prayers were finished, Jackson rose from his knees and stated that his path was clear ; he joined the South, carrying with him the perfervid zeal of one of Cromwell's colonels and an aptitude for war and a mastery of *ruses*, seldom rivalled since the days of Hannibal.

Here I may remark on the absolute necessity for perfect military organization and discipline, and a strong army with a clearly defined status in every country, under every form of government. A regular army, 50,000 strong, under the absolute control of the central government, would have nipped rebellion in the bud, and would have saved both South and North from four dreary years of internecine strife ; from an expenditure of money greater than was incurred in all the other wars since Waterloo, the Franco-German war included ; and from a loss of life without any parallel since the awful days when Napoleon left the grand army behind him on the vast expanse of snow from the Moskwa to the Beresina.

As I was allowed to say before in this Hall, quoting the most profound of our lawyers and philosophers, it is the most certain oracle of time that no nation can expect either security from external violence, or any permanent immunity from internal disruption, unless it sets its military house in order. In 1861, the United States had not a national army properly so called : therefore 500,000 federal volunteers perished and £1,000,000,000 of Federal money were spent before the union was re-established in 1865. Historical lectures are a waste of time unless lessons, such as this, be weighed and remembered.

We, of course, are now absolutely free from the passions which raged so fiercely round the international and other questions that were developed during this gigantic struggle, and we can look back on the policy of its statesmen and the strategy of its generals with impartiality as well as sympathy. One emotion, however, we need not control, we can all be proud of the heroism which both sides, equally sprung from our own imperial race, displayed, and of their dauntless resolution "never to submit or yield and, what is more, not to be overcome" while it was possible to fight on, and we can also, in common with competent critics of all countries, admire the magnificent military qualities displayed by the respective leaders.

It would be most interesting to discuss the myriad modes in which the fertile ingenuity of our transatlantic kinsmen was displayed. Every variety of weapon was tried ; some of these innovations have been permanently adopted ; naval warfare was revolutionized by Merrimacs and Monitors and other strange unsightly craft ; the use of the spade ; the use of cavalry in raids ; the destruction and repair of railways, which were of more vital importance in this than in other modern

campaigns, must not be discussed in this short lecture, but some references to them will be found in the appendix.

Before coming to the operations in Virginia, we must for a moment set forth the fact that, though these are the best known of the war, they are not the most wonderful, nor did they alone determine the fate of the South. A glance at any map will shew the vital importance to the Confederacy of that tremendous artery, the Mississippi. When the Federals, under Grant, Sherman, and others in 1862-3, got possession of the lines of the Cumberland and the Tennessee rivers, and took Vicksburg, they had, so to speak, turned the Alleghanies, and could move into the very heart of the enemy's country, and threaten the communications of Richmond with the whole territory between North Carolina and the Gulf of Mexico. Simultaneously with these operations from the North, another expedition, under Admiral Farragut and General Butler, seized New Orleans—a great Southern emporium—and a strict blockade was established on the western coast, which rendered Confederate communication with the outer world almost impossible. These proceedings of course crippled the Confederacy, and directly affected the situation in Virginia. After their victory of Chattanooga, 1863, the Federals might hope, by a movement eastward, to cut the enemy's resources in two, and, gaining a new base on the sea, proceed from Savannah and Charleston northwards towards Richmond, which would at the same time be assailed by the Federal armies in Virginia, and this was actually the principle underlying the justly famous campaigns of Sherman in Georgia and Carolina, 1864-65.

Before we analyse the campaigns in Virginia, it is necessary to discuss its topography and how far this affected the Federals, whose base, till they won the Mississippi, may be broadly described as bounded by the Potomac river, and as including all the territory to the north and west of it, and whose object was Richmond.

The lines of advance clearly were (1st), up the Shenandoah Valley—the fertile and beautiful valley of Virginia—from Harper's Ferry, by Winchester to Staunton, and thence to Richmond, or (2nd), from Arlington and Alexandria to Manassas Junction, and thence by Culpeper to Gordonsville and Richmond; this line could be connected with the valley line by the gaps in the Blue Ridge and by the railways running from Manassas and Charlottesville westward; another line (3rd), was from Acquia Creek to Fredericksburg, and thence by Hanover Court House to the Confederate capital. In the event of a simultaneous advance east and west of the Blue Ridge there was no small danger, lest the defender, acting on interior lines, might imitate the Archduke Charles, in 1796, or Napoleon, in 1814, and beat each section of the invaders in detail. There were great difficulties in the way of a movement by the second line; obstacles in the shape of frequent streams, and rivulets soon swollen into rivers by a few days' rain; woods and swamps; the notorious "wilderness"; and the mud of Virginia, as hard to traverse by any army as the road from Point-au-Jour to Gembloux was to Grouchy, after the battle of Ligny; of course, on the third line, the rivers became even more trying impediments to the progress of an invader.

To advance by all three lines was to run the risks inseparable from division of force, while to move by the two more eastern routes, and, not to utilize the valley, was to expose the Northern States to a irruption from the valley, or a "raid" by some brilliant cavalry leader such as J. E. B. Stuart, followed by the flower of the Southern cavaliers and their

splendid horsemen, who rivalled in daring and varied efficiency the dragoons of Gustavus and the cossacks of Platoff. But the Federals had all the advantages of a re-entering frontier, which gives such choice of plans to an able general, and such chances of escape to one who is unfortunate. They had, moreover, the command of the sea; they could therefore have used their superior numbers to close the avenues leading on Washington, and into Maryland, to any forces that the Confederates could dispose of against either, and, descending into the Chesepeake Reach from their depôts on the Potomac, could have moved up the rivers York and James. After establishing new bases on these rivers, they would have turned all the enemy's positions from the Bull Run to Gordonsville, and have planted themselves within a few strides of Richmond. Better still, they could move from City Point on Petersburg, and, cutting all the lines to the more Southern States, have isolated Richmond, and compelled its evacuation at once, or its surrender after a short siege.

The advantages of flank as against front attacks were obvious to all the soldiers of the North as well as of the South. The officers educated at the famous West Point School added to their strong native common sense no small knowledge of the practice of Napoleon and the theories of Jomini. It would be well if history were as carefully studied at our own schools.

The true method of conquering the Seceding states was foreseen and described by men of skill and experience like Generals Scott and Sherman from the very first, and General McClellan was actually within twenty miles of Petersburg in July, 1862. But when, or in what state, did the arrogant and ignorant leaders ofthe masses listen to any voice except the clamour of faction? The teachings of military wisdom were spurned by the chiefs of a triumphant caucus till the stern lessons of a terrible necessity, resulting from years of constant and awful suffering, compelled the politicians at last to retire from the direction of the army, and, leaving war to the soldiers of General Grant, turn again to their natural vocation of deceiving the multitude. In this lecture we cannot follow the political intrigues that were so fatal to the Northern cause. They are recorded in the pages of every Federal authority—from Webb to Sherman—and our people ought to study them with a practical object. The South was better directed:—the President, Mr. Jefferson Davis, had been a good soldier in his time. Moreover, it would not have been so easy to impose delusions upon the planters of the Southern States as upon the uncultivated crowds of voters of the Northern cities; again from almost the very beginning harmony prevailed as a rule between the commanders in the field in Virginia and the political leaders in its capital.

The eagerness of the more incompetent advisers of Mr. Lincoln was inflamed by the unwonted spectacle of military power, which was suddenly arrayed in the neighbourhood of Washington after the challenge of the South at Fort Sumter. Fully 40,000 men rallied to the standard of the Union about the Capital, and nearly half as many more gathered round old General Patterson about Philadelphia, and soon occupied Harper's Ferry, from which the confederate leader in the Valley, Joseph Johnston, very wisely retired, as he had only a feeble force, towards Winchester. Moreover, a considerable body of troops collected round General McClellan about Wheeling in West Virginia, and not only defeated the confederates under Garnett at Rich Mount and Carricks'

Ford (July 11th and 13th), but won over the country between the Alleghanies and the Ohio to the union, and threatened to penetrate into the Valley itself, till circumstances, over which McClellan had no control, rendered it impossible for him to operate any longer in this portion of the theatre. Not only did these movements against the seceders thus begin in the North, but in the York Town Peninsula, that is the space between the York and James Rivers, the Federals displayed some activity, however, their commander, Butler, was soon stopped at Big Bethel.

The Campaign of 1861, is practically narrowed to the operations of Patterson (F.) *versus* J. Johnston (C.) in the Valley, and McDowell (F.) *versus* Beauregard (C.) along the Bull Run. Nothing could well be simpler than the situation. The Confederates held Centreville and the position along the Bull Run with some 20,000 men, who were decidedly of much better quality, individually, than their enemies. McDowell was at Arlington, and had some 30,000, with 10,000 in reserve. He could beat Beauregard alone ; he could not beat Beauregard if Johnston joined him. Manifestly therefore it was Patterson's duty either boldly to attack Johnston, who never had more than 12,000 as against his 20,000 men, and drive him well up the Valley away from Beauregard, or to move by his own left and keep Johnston away from the issues of the Blue Ridge leading on Manassas. He was distinctly ordered to adopt either alternative. He was timid and adopted neither. McDowell advanced on Centreville ; the Confederates retired behind the Bull Run. McDowell followed, and, not liking to force the river in front about Blackburn's Ford, manœuvred, July 18th-20th, to secure a passage on Beauregard's left flank by Stone Bridge and Sudley's Ford. He succeeded, but meanwhile Johnston easily eluded Patterson, and on the 19th marched 9,000 men to Ashby's Gap, while Patterson was at Charleston, and thence to the railway, and they arrived at Manassas in detachments so considerable on the 19th and 20th, as to enable Beauregard to defeat the enemy on the 21st. The Federals crossed the Bull Run at Sudley's Ford, while Beauregard's troops extended from Stone Bridge to the right of Blackburn's Ford. These, however, soon changed front and, being ably supported by Johnston's men, stopped the Federals throughout the forenoon and afternoon till the last of Johnson's troops having arrived at Manassas, Kirby Smith's brigade marched up from Manassas and entered into the battle from the woods west of Sudley, and other troops, who had been guarding the lower fords, came up also on the Federal right rear. The troops of McDowell now went to pieces and could not be rallied even at Centreville, and had to be led back into their camps by the Potomac.

Beauregard and Johnston could not follow up their victory, and contented themselves with occupying Centreville and constructing a series of works along the Bull Run, and sending Jackson to re-occupy the Valley, no very difficult duty.

Now the Federals recognized the serious nature of their task, and set up about calling large forces together from all quarters, either to the Mississippi and its tributaries, or to the Potomac. They were able to boast, at the end of the year 1861, of having more than 600,000 men under arms, and they had the good sense to recognize the fact that men with muskets are not soldiers, and they employed General McClellan, who had won some victories in West Virginia, to organize the "*Army of the Potomac.*" He did well, very well indeed, better than D'Aurelle de Paladines in 1870, but no genius can improvise a good staff, good

colonels and majors, good cavalry, and good gunners, and in these particulars, notwithstanding all their lavish supplies of men and money, the divisions of McClellan's army were sadly lacking. Indeed, it was not till well on in 1863, that the mounted branch of the Federal service could pretend to cope with the horsemen of the South.

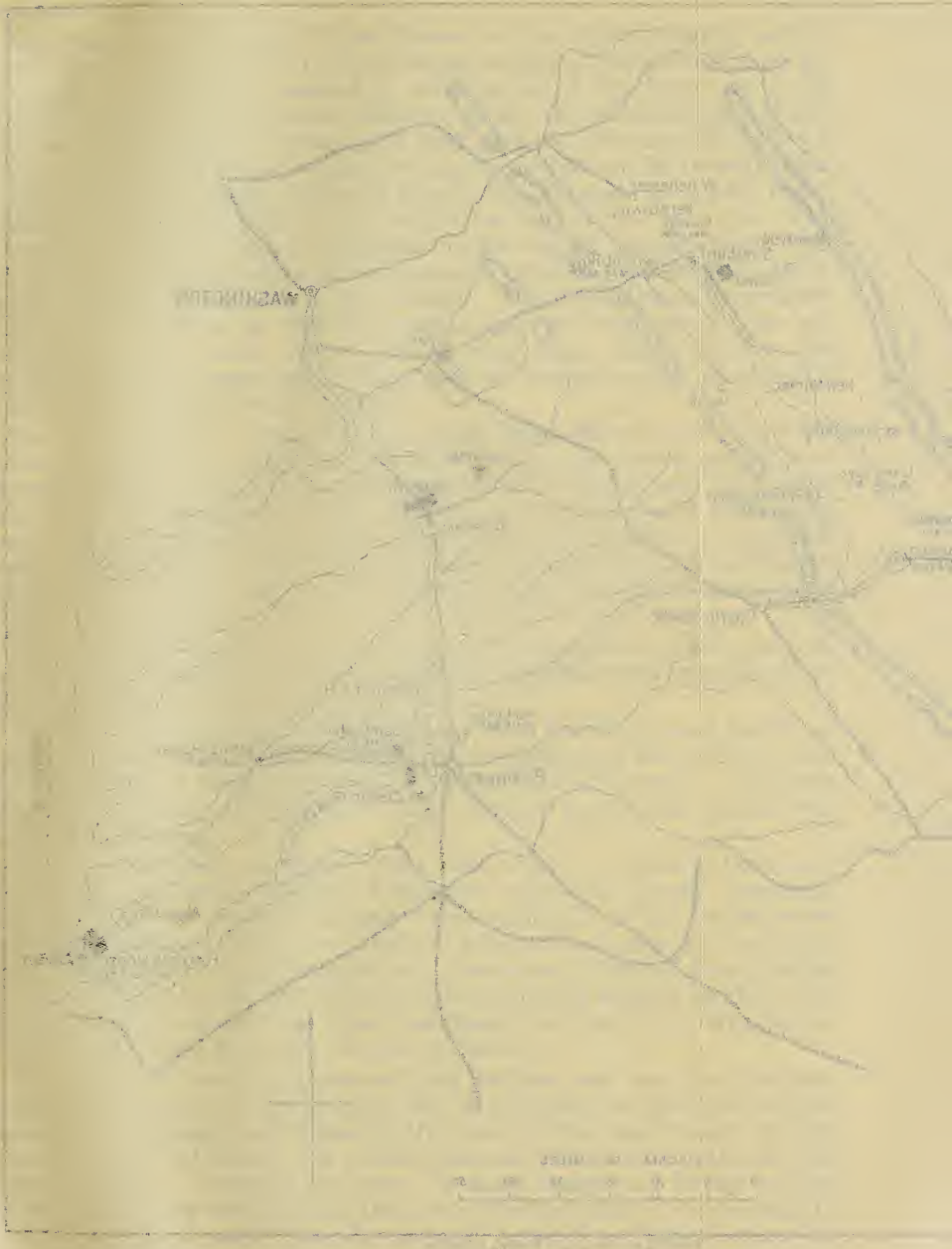
A skirmish at Ball's Bluff, in which the Northern folk met with a rude repulse, in October, broke the monotony of drilling recruits and teaching officers their duties. But, in the beginning of the new year, the war fever became very strong again in the press and in the War Office, now presided over by Mr. Stanton, no friend to McClellan. He was urged to advance ; he urged prudence and delay ; he had along the Potomac 200,000 men—a vast machine not yet ready to work smoothly. Other forces were mobilised and directed through West Virginia towards the Valley. At last, in March, an advance was made to reconnoitre the Confederate works, and a plan was adopted to dislodge them from their position by moving a large portion of the army to Urbana as a base, and thence by moving rapidly on West Point at the head of the York River, to threaten Johnston's left flank before he could be ready for the movement and to turn the tables by making the vicinity of Richmond, and not of Washington, the theatre of operations. This was a most judicious plan. An attack on the front of the enemy was difficult owing to bad roads, and besides was poor strategy. But Johnston had time to evacuate Manassas before it could be executed, owing to the delays of either the administration or the commander-in-chief. The Confederates retired behind the Rappahannock, with head-quarters at Gordonsville, and their troops in the Valley also, after some skirmishing near Winchester, fell back to Staunton.

McClellan's next plan was to go to the York Town Peninsula, land at Fortress Monroe, and move up the Peninsula to Richmond.

Washington had been protected by a cordon of independent forts, with a garrison of 20,000 men. Banks was sent with a good column into the Valley, and, advancing past Winchester, reached Strasburg, which he fortified, and, as we have seen, Fremont was coming with some 30,000 men by several passes into the Valley. A fatal mistake was made by president Lincoln, after McClellan had embarked his troops for the Peninsula ; McDowell's corps was detained under a strange delusion that Washington was in danger. It does not require much skill in war to know that the best way to protect Washington was to make a movement with overwhelming force on Richmond. McDowell, in due time, came down to Fredericksburg, but, after long wrangling between McClellan and the political authorities, it was finally resolved to keep him between the Rappahannock and the capital, and thus the ruin of the army of the Potomac began.

We now leave, for a while, the other portions of the theatre and follow McClellan's movements in the Peninsula.

After landing at Fort Monroe, he found that the enemy had constructed a series of defences in three lines to impede his progress and that he had to drive their able "detaining" chief Magruder across obstacles of which the most serious was York Town. However, he moved from Fort Monroe to York Town, which was evacuated once he was ready to storm it, and thence fighting his way along to Williamsburg, and thence to White House, which he reached May 16th, having been delayed for six weeks in a march of ninety-six miles by the able dispositions of the confederates, who were now under command

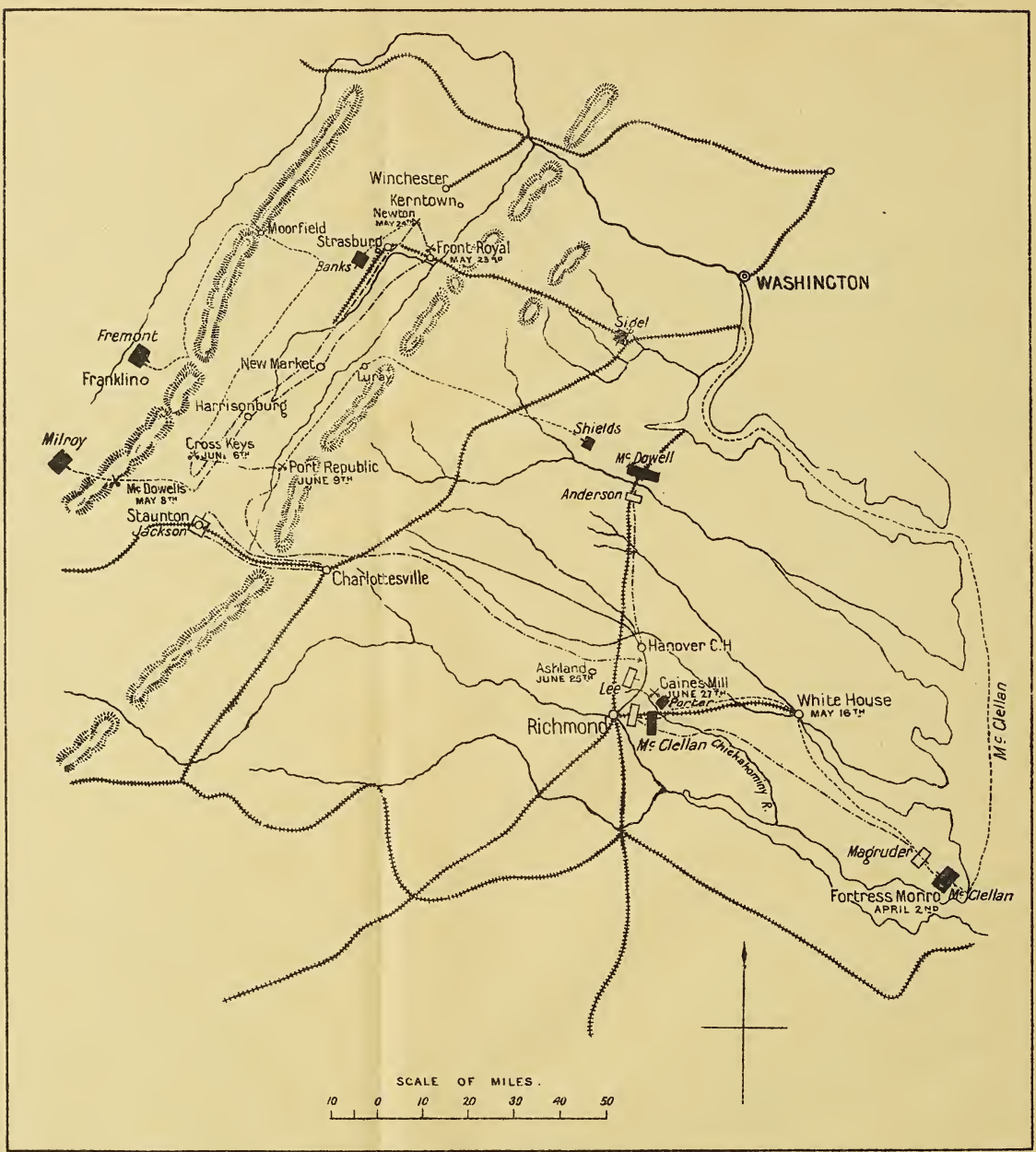

WASHINGTON

Sketch Map to show

JACKSON'S OPERATIONS IN THE SHENANDOAH VALLEY

and how he came to the assistance of LEE against PORTER at the Battle of

GAINES MILL, JUNE 27TH 1862.



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of "Joe" Johnston himself. The manner in which Magruder held McClellan is another illustration of the truth of the remark : "the right use of a detaining force is the principal weapon in the military armoury."

McClellan marched from White House to the Chickahominy, which was difficult to pass, rather by the swampy nature of the ground, than by its depth or width ; he crossed it with most of his force, and left General Porter on the north bank to watch the Confederates about Hanover Court House, to drive them back, and thus connect McClellan's own movement with that which he had proposed to McDowell from Fredericksburg. Joseph Johnston fought the Federals in a two days' indecisive battle at Fair Oaks, May 31st and June 1st. He was wounded ; but McClellan's movement on his capital was paralysed, and the Federals did practically nothing except entrench themselves on their front facing Richmond for a few weeks. The Confederates were now commanded by Lee in the Peninsula, and the temporary loss of Johnston, a very able officer indeed, was more than met by the appointment of a strategist as ready, and as imperturbable as our own great Duke of Marlborough himself.

Lee did not dare to assault the enemies' front, which was soon very strong, with not two-thirds of their numbers, so he determined to test the strength of their line of communication with White House and, with this view, sent Stuart with his cavalry on a raid. Stuart rode right round the Federals, doing them every possible damage *en route*, and back to Richmond. On his information, Lee determind to assault their position on the left bank of the Chickahominy, and this movement began on June 25th.

But, meanwhile, events took place in the Shenandoah Valley, which had a disastrous effects on the *morale* of the Federals, and brought about the ruin of their military combinations.

We have seen that Banks and Fremont from the North and the West were moving into the Valley, and, in the beginning of May, Milroy was with the right of Fremont's force moving towards Staunton. Fremont himself was about to enter the Valley further north and Banks was south of Strasburg.

Jackson now fell on Milroy near McDowell's, defeated him, and forced him to retire towards Franklin, where he joined Fremont. Jackson, with his swiftly moving "*foot cavalry*," as his troops were called, advanced on Banks, who fell back into his works at Strasburg, and, turning to the right, attacked and destroyed a Federal force, under Kenly, at Front Royal, and thence pressed forward against Banks, who, hearing that his flank was thus threatened, retreated in confusion to Winchester, where he stood, but was defeated.

The news of Banks' reverse and that Jackson was on the Potomac, alarmed the people of Washington, and the advisers of the government insisted on turning back General McDowell, who was already on the march to join McClellan, and ordered him to send a force under Shields into the Valley. Jackson was now in some danger of being cut off from Staunton by the Federals from the West and East ; but he rapidly counter-marched, after liberally helping himself to Banks' stores at Strasburg, and interposed between his opponents, and, regaining his base, faced about, beat Fremont at Cross Keys and Shields at Port Republic, and got back to Staunton covered with glory.

With 13,000 men he had, according to General Imboden, defeated an aggregate of 64,000 in thirty-five days, marching 245 miles and winning four desperate battles. These were certainly the most rapid and brilliant operations of war since Napolean had cut to pieces Blucher's army on the Marne in 1814.

In their strategical consequences they were far reaching; they not only delivered the Valley—the great magazine of the Southern armies of Virginia—from all hostile troops, they brought about the ruin of McClellan's plans by paralysing McDowell's force. There is no small reason for the statement of the Federal commander-in-chief:—"It is my opinion that had the command of General McDowell joined the army of the Potomac in the month of May, by way of Hanover Court House, from Fredericksburg, we would have had Richmond within a week after the junction."

With admirable secrecy and with no end of *ruses*, Jackson evacuated the Valley and moved to Ashland to take part in a scheme which Lee proposed against McClellan's right under Porter, north of the Chickahominy. He hoped by turning the enemy's flank to prevent his moving by positions under cover of his heavy guns, to within shelling distance of Richmond.

On June 26th, the army of Lee, leaving Magruder to protect Richmond, moved, by Meadows Bridge, across the Chickahominy; after a fight at Mechanicsville, the Federals retired from the strong position of Beaver Dam Creek to Gaines' Mill. Jackson arrived in time to take part in the battle next day, June 27th, and, at the same time, Magruder advanced, in a succession of feints, against the union line south of the Chickahominy. The result of the battle of Gaines' Mill was that Porter was defeated, and only saved by the fact that his retreat was covered by fresh troops from the south of the river.

Lee supposed that McClellan would try to hold his base at White House, and retreat by way of the Peninsula, but the Federal general resolved to make a "strategic movement to his rear" on the James River. He evacuated his magazines at White House, and when Lee saw through his intentions, he had had twenty-four hours' start and his plans were well advanced towards execution. He sent 5,000 waggons, 2,500 head of cattle, and his reserve artillery across the White Oak Swamps, and he guarded the roads through the swamps to protect the passage of his trains and troops from a flank attack during the march. His precautions were all needful, for he was persistently assailed by Magruder, Longstreet, Hill, and Jackson, at Allen's Farm, Savage Slatim, Glendale, and Malvern. However, all these rear guard engagements, and especially the last, were well managed, and, by July 2nd, he was safe under shelter of his gun boats at Harrison's Landing.

Lee, whose army had been exhausted in seven days of constant fighting, did not venture to assault this position, and the Confederates were content with having delivered their capital, and prepared themselves for some new development of the enormous resources of their enemy.

This Federal change of base, from the York to the James, was one of the ablest movements ever made by way of retreat, and during it the army of the Potomac was only saved from disaster by the perfection of its organization and the personal affection entertained for General McClellan by the officers and men of his army.

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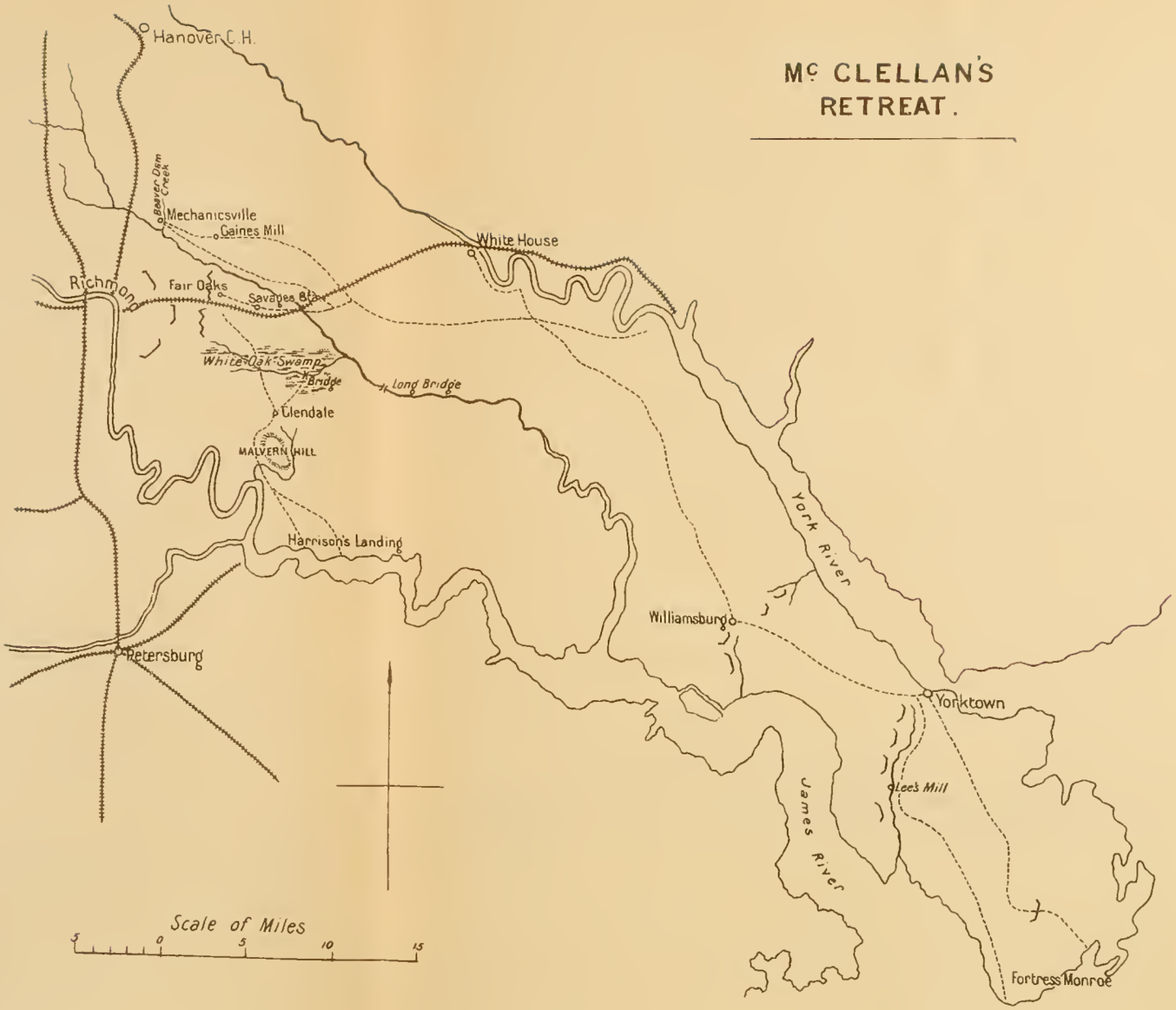

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The authorities at Washington, having ruined their General's plan, now cast about to supersede him. General Halleck became their military adviser, and they resolved on forming an army of Virginia on the Rappahannock, composed of the troops of McDowell, Banks, and Fremont who resigned and whose command was given to Sigel; this army was put under Pope, an officer who had gained some fame on the Mississippi, and whose views and methods were more in accordance with those of the cabinet than were McClellan's. The latter leader was to be obliged to evacuate the Peninsula, and his corps were to go up the Potomac, and to serve as supports and reserves to General Pope's forces, which were to move on Gordonsville and thence on Richmond. In other words, the army, which was safely on the James, almost within reach of Richmond, was to return to Acquia and Alexandria, and thence work its way across all kinds of obstacles to the James again. It is not strange that its commander protested, but as he had to obey he did his duty by getting his army securely to the several places of embarkation down the Peninsula.

Meanwhile Pope had made himself laughable and execrable by fulminating ridiculous manifestoes on the art of war, and by harassing and maltreating the people of Virginia. He did not display much promptitude, notwithstanding all his bluster, and allowed General T. Jackson to anticipate him by occupying Gordonsville, a decisive strategic point on the way to Richmond, while Lee protected that capital against McClellan. In the beginning of August, at Cedar Mount, Jackson inflicted a sharp blow on Banks, but, as being much inferior in force, had to retire behind the Rapidan. When it became obvious to Lee that McClellan's troops were really quitting their postition at Harrison's Landing with the object of going north, he sent General Stuart with his cavalry to the aid of Jackson, and soon followed himself to the Rappahannock.

It was now obvious, first, that Pope's army was too strongly posted on this river to be defeated by a front attack, and second, that his numbers were being augmented by the troops from the Peninsula, and that, already superior in numbers to Lee, he would be almost irresistible when joined by all his reinforcements. The only course left to the Confederates was to dislodge him by a flank movement, and with this view to divide their own forces, if necessary :—a dangerous piece of strategy.

Lee, therefore, watched Pope along the river, while Jackson, by a long circuit, was to fall upon his rear at Manassas. It will be observed that turning flanking operations were very popular with Lee and Jackson. They were influenced by the character of their troops and the nature of the country. The men of both armies were comparatively raw levies, highly susceptible to the influence of surprise, and the appearance of an enemy on their flanks or in their rear was calculated to throw them into disorder. The wooded character of the theatre of war, moreover, facilitated such movements. Jackson, with admirable secrecy, moved across the Rappahannock by an almost forgotten ford, pushed on by Salem to Thoroughfare Gap, reached Manassas on the night of August 26th, took it, and next day destroyed the great depôt. Pope now hastened north to protect it, but was delayed by one of Jackson's chiefs (Ewell), at Bristoe, and another force sent from Washington to save the magazines, was defeated. Jackson, having caused Pope to turn right round, and diverted his army from the direction of Richmond to the Bull Run, had to

look sharply after his own safety, for the enemy was more than three to one, and more reinforcements from the army of the Potomac were arriving on the scene. He retired to Sudley's Ford by roads north and south of the Bull Run, and resolved, by occupying a strong position south of that river, and perpendicular to it, to delay Pope's army and wait for Lee, who would soon come to his aid. We have not time to follow Pope's marchings and countermarchings, or to inquire into the merits of the disputes between him and McDowell and Porter, his subordinates. It is very clear that he quite misunderstood the situation.

His true policy was to obstruct Thoroughfare Gap, the only road by which Lee could reach Jackson quickly, and, having closed this issue, crush Jackson betimes. McDowell could and would have stopped the Gap, but was ordered to Manassas, where Pope hoped (to quote his words), to "bag the whole crowd" of the opposite side. So the Gap was left open. Jackson was attacked on the 28th and 29th, but resisted gallantly, and on the 30th Lee took Pope's army in flank and drove it over the Bull Run. Jackson turned Centreville also September 1st, after a combat at Chantilly, but (September 2nd) Pope, though now joined by two fresh corps of McClellan's army under Sumner and Franklin, fell back through Fairfax Court House on Washington.

The chiefs of a democracy can, like other folk, be as base in adversity as arrogant in prosperity, and President Lincoln and his "advisers" now begged McClellan to resume his old position on any terms, reorganize the routed army and save the Federal capital. He consented, but gave a modern example of the conduct which Roman Chroniclers ascribed to the ancient heroes of their history, he refused to bargain for his services till he had secured the safety of his country. He took the command ; he saved the capital ; under him the army of the Potomac again moved ably and fought with daring, but he was soon to experience another truth taught by the same chroniclers, that to trust the wire pullers of the populace is to "swim with fins of lead."

The fortifications of Washington and the River Potomac were serious obstacles, and accordingly Lee resolved to enter Maryland, and on September 3rd he advanced on Leesburg and crossed into Northern territory. He thus drew away the invaders from Virginia ; he hoped to get recruits in Maryland, many of the people being well disposed to the South, but in this he was disappointed. He further hoped to pass through the South Mountains, lead the enemy after him, still keeping his communications with the Shenandoah Valley open, by means of Jackson's force, which was to take Harper's Ferry. When he had led the enemy up far enough, he trusted that he might defeat them in a decisive battle, take Washington or Baltimore, and end the war. He was, however, soon anticipated in the South Mountains by McClellan, with very superior forces, and obliged to fall back to the Antietam, where he took up a strong position, and waited till the arrival of Jackson from Harper's Ferry, enabled him to repulse the Federal onslaught about Sharpsburg, September 17th. Lee crossed the Potomac near Shepherdstown, and in a few days was safely encamped along the Opequan in the Valley, with head quarters at Winchester.

Stuart now made another "raid" on a remarkable scale. He rode right round the enemy's whole army. With 1,800 troopers and four pieces of horse artillery, he crossed the Potomac above Williamsport, marched to Chambersburg, in Pennsylvania, destroyed the machine shops and a vast amount of military stores, and moved to Frederick

City. Evading every effort of the enemy to cut off and destroy him, he reached a ford on the Potomac, north of Leesburg, and recrossed into Virginia with a large number of captured horses, having passed over one hundred miles in forty-eight hours.

When McClellan, in turn, invaded Virginia, Lee simply crossed the Blue Ridge and took up a position in front of him at Culpeper. McClellan had advanced to Warrenton, November 7th, when he was abruptly deprived of his command, which was handed over to Burnside.

The new Federal leader resolved, in spite of the lateness of the season, to move to Fredericksburg, cross the river Rappahannock on pontoons, and force his way to Richmond. The result was a bitter disappointment. When he was ready to pass the river, the confederates were strongly posted on the south bank about Marye's Height. Every desperate assault by the Federals, lead by Fighting Joe Hooker and other chiefs, was repulsed, and Burnside, who appears to have lost his head at the close of the desperate battle of Fredericksburg (Dec. 10-15), retired again to the north bank. From every point of view, this was a fearful disaster to the invaders, and, early in the new year, Hooker superseded the defeated general.

Lee was still south of the river, about Marye's Hill, in the spring, but his force was not more than 50,000 at most, as Longstreet's troops had been sent south of the James river. Hooker resolved to cross the rivers Rappahannock and Rapidan by Ely and Germanna Fords, and, by turning Lee's left, gain the Richmond road while an attack would be made on the confederate position at Marye's Hill by Sedgwick. This led to the celebrated battle of Chancellorsville, April 29th and May 5th, 1863. This battle was won by another, and the last, of Jackson's flank marches. Hooker entered the Wilderness and constructed formidable works, which Lee watched in front, while Jackson marched through the wooded and intricate country, and fell up the adversary's unguarded line in the rear, cutting him off from the road by which he advanced, and compelling him to turn his back to the river, over which, after continuous fighting for days, both Sedgwick and himself had to retire. This Confederate triumph was dearly bought; Jackson was mortally wounded by his own men in mistake, and died a few days later (May 10th).

After this great victory, Lee resolved to re-enter Northern territory, and again transfer the theatre of war from Virginia to Maryland and Pennsylvania. We have not time to discuss the campaign of Gettysburg, and it does not belong to our theme, although so closely related to it that a few words about its object are necessary. Lee's army was now recruited and enthusiastic, and so elated were the Southern people that they supposed there would be a final victory on Northern soil, followed by a peace. Lee was not opposed to an offensive war. "The Scipio Africanus Policy" seemed to him better for the South than the tactics of Fabius. His theory was that the South ought to keep the enemy as far as possible from the interior, fighting on the frontier and on Federal soil when possible. Thus, the South would be protected from the ravages of the enemy, and the Confederate capital would be safe from danger. As long as the enemy was held at arms' length north of the Rappahannock, Richmond, with her net-work of railways connecting with every part of the South, was safe, and the government, undisturbed in their capital, remained a power in the eyes of the world. Another important matter was the question of supplies always deficient; in these

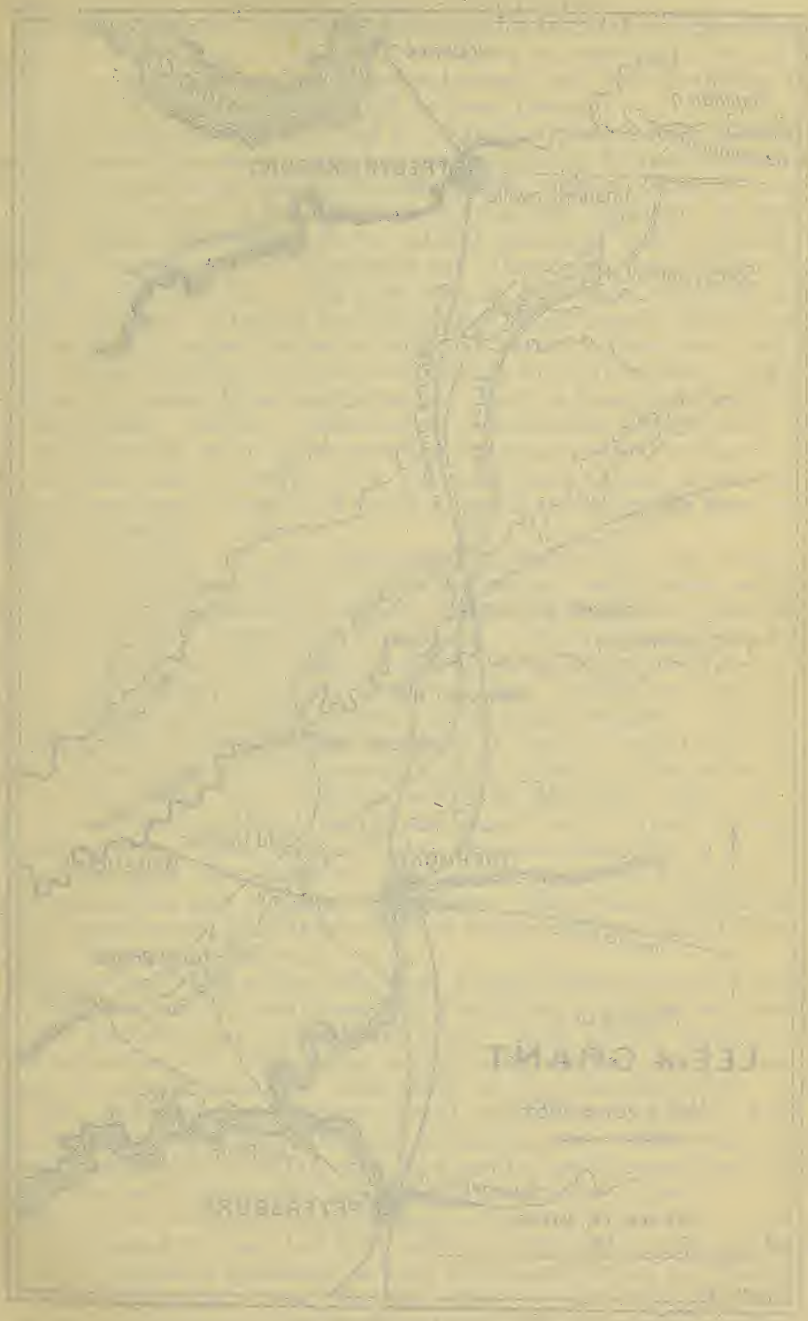
the Confederates were now worse off than ever. When Lee sent to Richmond for rations after the battle of Chancellorsville, the commissary-general is said to have endorsed upon the paper, "If General Lee wishes rations, let him seek them in Pennsylvania."

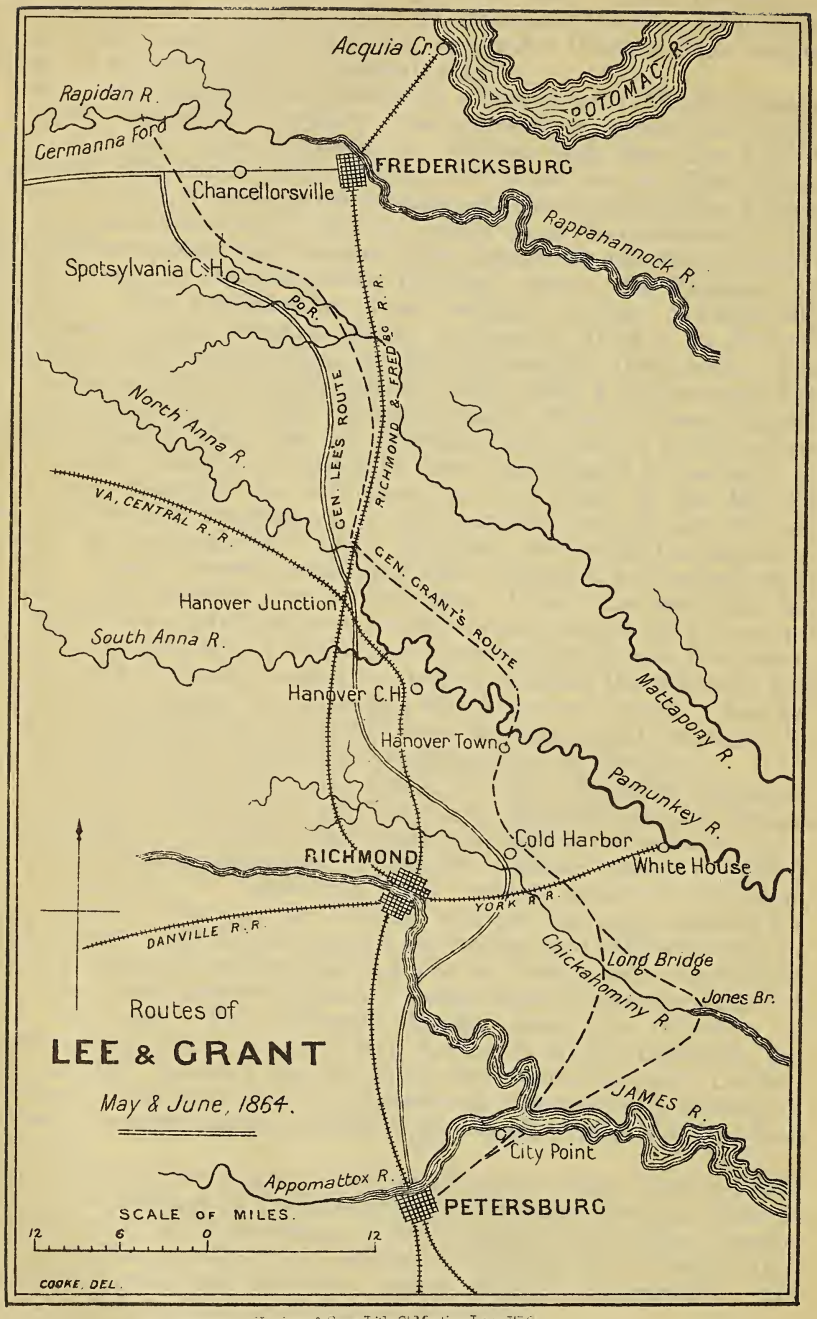
With a well-equipped and admirably officered army, 68,352 infantry and 10,000 cavalry and artillery, Lee prepared to invade the North. Ewell, with one corps, advanced, by Chester Gap, into the Valley, re-captured Winchester from Milroy, and went on to Martinsburg, followed by Hill, while Longstreet occupied Ashby's and Snicker's Gaps, assisted by Stuart's cavalry. Ewell pushed on to Chambersburg; Hill and Longstreet passed the Potomac at Shepherdstown and Williamsport; Hooker, from the Rappahannock, followed across the Potomac, by Leesburg. The Confederates were rapidly moving towards the Susquehanna, when General Meade superseded Hooker as Federal commander, and, on June 30th, he was approaching Gettysburg. Lee concentrated around this place (1st July) and, after a furious series of attacks, for three days, on the enemy's position, failed to carry it, and, although Meade's army was too exhausted after one of the bloodiest battles of the century, to attack in turn, he thought it desirable to retreat into Virginia. He withdrew, on the night of the 4th, by Chambersburg and Hagerstown or Williamsport, crossed the river on pontoons on the morning of July 14th, and was safely back again in Virginia. Meade crossed southward near Leesburg, Lee retired from the Valley by Chester's Gap to Culpeper. It will be seen that the English and French did not more frequently move across the Rivers and Sierras on the frontiers of Spain and Portugal, during the Peninsular War, than did the hostile armies in Virginia traverse the Potomac and the Blue Ridge, during the campaigns which are our subject. Lee put his army into quarters on the south of the Rapidan, closely watched, in October, by the enemy, whose head-quarters were in Culpeper.

In this month Lee made a bold move to turn Meade by moving to his own left, on Warrenton, and thence on Manassas on the Federal communications. But this dash failed, as Meade retreated in time, and, after a rear guard action at Bristoe, leaving Stuart to pursue to the direction of Centreville, Lee retired again to Culpeper, giving orders to tear up the railway, and put his army behind the Rappahannock. But Meade repaired the railway and followed him up. He fell back behind the Rapidan, and put his troops, who wanted rest badly, into winter quarters: then the enemy made a determined effort to pierce his lines. But, although Meade, from the direction of Germanna Ford, did all he could from November 27th to December 1st, he did not dare to attack the enormous entrenchments which Lee had improvised. The great system of breastwork was now fully developed, and Meade declared that he could not carry them with a less loss than 30,000 men.

Thus ended the campaign of 1863 in Virginia, where Lee still held his own; but the loss of Vicksburg on the Mississippi and the defeat of the Confederates at Chattanooga on the Tennessee, more than counter-balanced all the results of his admirable strategy and brought into prominence Grant and Sherman, whose efficient co-operation with Grant in 1864-5 resulted in the ruin of the South.

We must now hurry over the extraordinary campaign from May to July, 1864, in which Lee, on an inner line constantly moving to his right, foiled every attempt of his opponents to reach Richmond, from





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the fords of the Rappahannock to Spotsylvania and then to Hanover Town and Cold Harbour and thence to Petersburg.

When Grant was appointed commander-in-chief of the Federal army, he knew that to beat Lee would be no easy task ; but he was even more pertinacious than Masséna himself, and kept pounding away in spite of all kinds of reverses, till he wore Lee out.

As he wrote, the true plan was to " hammer continuously against the armed force of the enemy and his resources, until by mere *attrition*, if by nothing else, there should be nothing left " but submission.

Grant was north of the Rapidan, having got command of Meade's army, which was reinforced to 141,000 men and well supplied ; he crossed it successfully by Germania and other fords above Chancellorsville, May 4th and 5th. His plan was to fight Lee, who had about 50,000, between Culpeper and Richmond if he would stand, then to advance straight upon the latter city and invest it from the north and west, thereby cutting its communications in these directions ; and then, crossing the James River above the city, form a junction with the left of Major-Gen. Butler, who, moving with about 30,000 men from Fortress Munroe, at the moment when the army of the Potomac crossed the Rapidan, was to occupy City Point, advance thence up the south side of the James River, and reach a position where the two armies might thus unite.

Grant marched into the Wilderness, thinking that Lee would fall back, but to his amazement the latter moved, with three columns, towards the Wilderness, and offered battle. A desperate combat of an unexampled kind ensued for two days in a dense thicket, from which Grant was only too glad to take advantage of the darkness to move into more open country, and he made a night march, on the 7th, to Spotsylvania, harassed by Stuart's dismounted cavalry. When the Northern column reached the Po river at Spotsylvania Court House, they were stopped by the breastworks of the enemy. After manœuvring for a few days, the Federals made a desperate rush on their opponent's position, May 12th, but failed and were obliged to wait for reinforcements. Grant then moved to Hanover Junction on the North Anna, but Lee saw through the design, and, on May 23rd, had anticipated him and repulsed his assault. Meanwhile, Sheridan had made a cavalry raid to within touch of Richmond, and killed Stuart at Yellow Tavern and returned.

Grant on the night of the 26th, went towards Hanovertown, preceded by Sheridan's cavalry, and crossed the Pamunkey ; but Lee had marched to Cold Harbour, and stopped him again. Both parties threw up vast entrenchments and, after some manœuvring another great action all along the confederate line took place on the Chickahominy. After daylight, June 3rd, the federals rushed their troops on Lee's front in vain, and with a loss of 13,000 men in half-an-hour. This was a heavy blow. Grant had lost 60,000 men in a month, and was repulsed almost at the very point where McClellan fought two years before.

Both parties remained watching each other till June 12th, when the Federals moved by their left flank across the Chickahominy, and passed the River James on pontoons to City Point, and moved on Petersburg.

Butler had sailed from Fortress Monroe, and reached Bermuda Hundred, a Peninsula opposite City Point, and entrenched himself in works to which he was soon confined by General Beauregard from the South. He was as completely shut up, to use Grant's words, " as if he

had been in a bottle strongly corked." Grant reached Petersburg June 15th ; he was held on that day by the local troops ; but on the 16th he found that Lee, who had crossed the Potomac at Drury's Bluff, was again in front of him.

Lee began to draw a regular line of earthworks around the city to the east and south, when he was furiously attacked, 16th, 17th, and 18th, and 21st and 22nd, all to no purpose. The Federals lost some 8,000 men for nothing, just as the Russians wasted their men in 1877 against the works of Plevna, and they had to adopt the course which the Russians also had to fall back upon, *i.e.*, by a regular siege invest the long line of fortifications, and, by extending their own lines westward, cut off their opponents from their resources in the south.

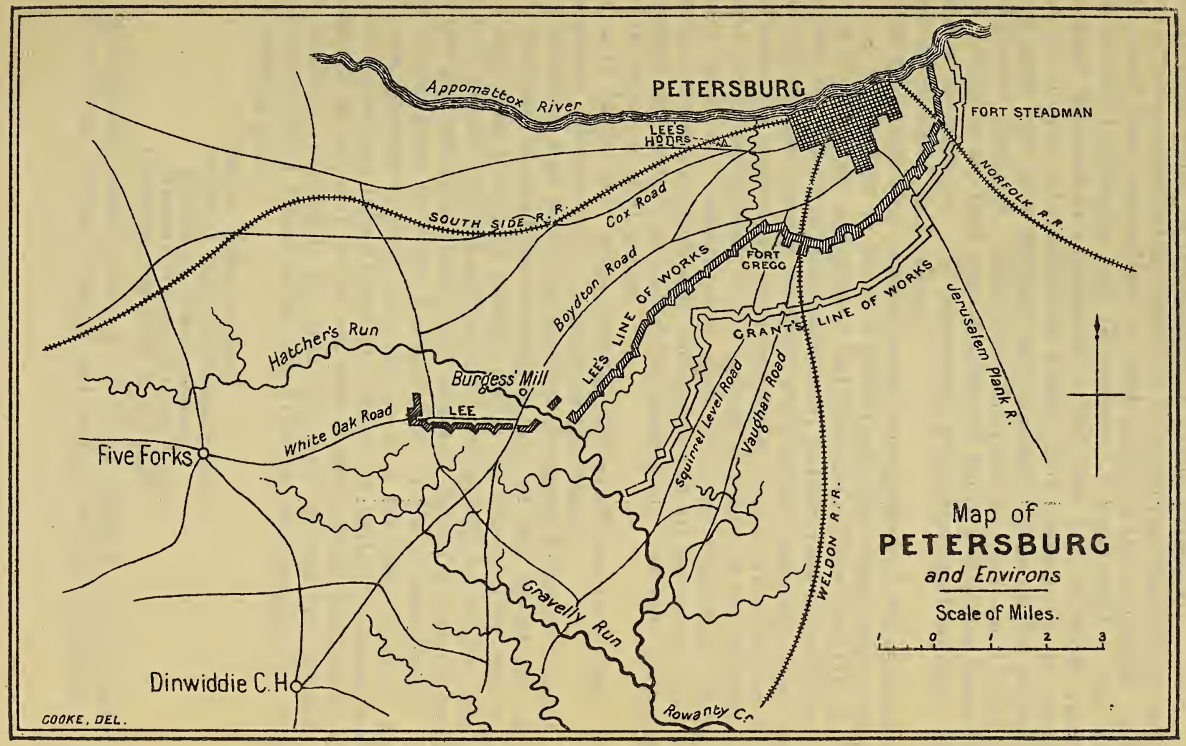
The leaguer of Richmond was singular ; an army of 40,000 or 50,000 men, intrenched along a line extending finally over a distance of nearly forty miles, was defending against a force of about thrice its number, a capital more than twenty miles in its rear, and from July of one year till April of the next, the Federals would have ruined the confederacy at any moment by breaking this line.

We must pass over the incidents of the investment, such as the explosion of the great mine in July. Nor can we dwell on Early's attempt to turn the tables on the Federals by issuing from the valley, and crossing the Potomac and threatening Washington ; nor on the celebrated campaign at the close of the year, when Sheridan took the command of the unionist troops in the Shenandoah Valley, and, driving the seceders before him, devastated the country to such an extent that, so far from its being the provision store of Richmond, "a crow that wanted to fly up the valley would have to bring his supplies with him." Nor were these all the misfortunes of the Confederates. By the end of the year 1864, Sherman's operations in Georgia were a heavy pressure on their almost exhausted resources. Johnston and Hood were driven from the Tennessee to Atlanta, that town was depopulated by Sherman, who then marched almost unresisted to Savannah, and thence, capturing Charleston *en route*, to Goldsboro' in North Carolina, where he threatened Lee's retreat from Virginia.

The position of affairs was desperate, but in February Lee might have still retreated south by Amelia Court House, and, joining Johnston, have prolonged the war in the Gulf States. The civil authorities prevented the execution of this plan, and still the fighting round Richmond continued, and the hail of missiles from the numerous Federal batteries fell upon the half-manned trenches. But by March, Grant's works had extended towards the Southside Railway, from Petersburg to Danville, and, after failing to break the enemy's centre by an attack, March 25th, Lee felt that the final struggle was at hand. He prepared to cope with the Federal movement against the Southern line by taking up a position at Five Forks, and made a fierce assault on the enemy, March 31st. He was repulsed, Sheridan took Five Forks, April 1st, and seized the Southside Road, and so feeble was the force now defending the works before Petersburg, that Grant carried them April 2nd.

Lee now had to retreat, and evacuated the place in the night, and moved on Amelia Court House, where he expected a train with provisions, but this train by mistake had passed on to Richmond, and he found himself without supplies.

On the night of April 5th he moved towards Lynchburg, but on his flank was Sheridan's large cavalry force. At Appomattox Court House



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he found himself in front of an enormous superiority of force, and the surrender of some twenty-five thousand confederates and their illustrious leader to General Grant, on April 9th, closed the trying and terrible series of struggles which had for four years concentrated the attention of the civilized world on the theatre of war in Virginia.

The lecturer concluded by referring to certain matters which will be found quoted from authorities on both sides, in the appendix, and by saying—Colonel Spragge and Gentlemen, I have tried to set forth the leading features in campaigns, which are full of most valuable lessons, not only to all students of history and, particularly of strategy, in every land, but in a marked and especial degree to the politicians and soldiers of England. This is not the place to dwell on the political lessons, except to say that once campaigns begin politicians should not interfere with strategy. All American politicians and soldiers alike now see the truth of this axiom.

But for us, whose very regular army is composed of volunteers, how fruitful of instruction is all that pertains to the organization, supply, officering and training, equipment, and discipline of the 1,000,000 of men, who moved from their northern homes by rail and road to neighbouring battle-fields against people of their own colour, language, and race; and, whether we approve of their principles or not, we must not refuse the meed of our admiration to the ardent courage of the 250,000 Confederates, and the energy and skill of their illustrious generals. For our part we can do justice to both sides, and all parties in the States again united, are equally proud of the genius and devotion of Lee and McClellan, Stuart and Sheridan.

It is only lately that some leading officers of our own army have paid generous tributes to the memory of Sherman.

The generation that played its part on the battle-fields of Virginia, or from a distance watched the varying phases of the operations of the contending forces, is rapidly passing away, but few of them will regret, few even of the confederate soldiers now living, will regret that they are leaving the glorious American union intact in peaceful security behind them to be the hope of many a generation of their descendants. Let us apply the lessons of their experience to a far more ancient state, a still more glorious inheritance, the safety of which is committed to the charge of us all, and in an especial degree of the gentlemen who have so patiently listened to me this evening. To our own country, as well as to the United States across the Atlantic, we can apply the words of the American poet—

> "Sail on, O Ship of State,
> Sail on, O Union, strong and great;
> Humanity, with all its fears,
> With all its hopes of future years,
> Is hanging, breathless on thy fate."

The proceedings closed with a vote of thanks to the lecturer, proposed by Lieut.-Colonel Spragge and carried with acclamation.

APPENDIX.

THE SEVERAL STATES.

States which separated from England, 1783.

MASSACHUSETTS.
CONNECTICUT.
NEW HAMPSHIRE.
RHODE ISLAND.
NEW YORK.
NEW JERSEY.
PENNSYLVANIA.
DELAWARE.
MARYLAND.
VIRGINIA.
NORTH CAROLINA.
SOUTH CAROLINA.
GEORGIA.

Free Population, 2,614,000.

Confederate States (South).

SOUTH CAROLINA.
MISSISSIPPI.
ALABAMA.
FLORIDA.
GEORGIA.
LOUISIANA.
TEXAS.
TENNESSEE.
NORTH CAROLINA.
ARKANSAS.
EASTERN VIRGINIA
with Territories of
NEW MEXICO and
ARIZONA.

Inhabitants, 9,000,000, of whom 4,000,000 were Slaves.

States of Doubtful Politics.

MISSOURI.
KENTUCKY.
MARYLAND.

Federal States (North).

NEW HAMPSHIRE.
MASSACHUSETTS.
RHODE ISLAND.
CONNECTICUT.
DELAWARE.
NEW YORK.
PENNSYLVANIA.
VERMONT.
COLUMBIA DISTRICT.
OHIO.
INDIANA.
ILLINOIS.
MAINE.
MICHIGAN.
IOWA.
WESTERN VIRGINIA.
WISCONSIN.
CALIFORNIA.
MINNESOTA.
OREGON.
KANSAS.
NEBRASKA
with some new Territories
as
NEVADA,
COLORADA.

Inhabitants, 20,000,000.

DESTROYING RAILWAYS.—The destruction of railway communication between the confederate army at Richmond and the Gulf States, had been a very important part of Sherman's purpose, and he spared no pains to do this thoroughly. A battalion of mechanics was selected and furnished with tools for ripping the rails from the cross-ties, and twisting them when heated, and these we kept constantly at work ; but the infantry on the march became expert in methods of their own, and the cavalry also joined in the work, though the almost constant skirmishing on the flanks and rear of the army usually kept the mounted troops otherwise employed. A division of infantry would be extended along the railway line about the length of its proper front. The men, stacking arms, would cluster along one side of the track, and at the word of command, lifting together, would raise the line of rail with the ties as high as their shoulders, than at another command, they would let the whole drop, stepping back out of the way as it fell. The heavy fall would shake loose many of the spikes and chairs, and seizing the loosened rails, the men using them as levers, would quickly pry off the rest. The cross-ties would now be piled up like cob-houses, and with these and other fuel a brisk fire would be made ; the rails were piled upon the fire, and in half-an-hour would be red hot in the middle. Seizing the rail now by the two ends, the soldiers would twist it about a tree, or interlace and twine the whole pile together in great iron knots, making them useless for anything but old iron, and most unmanageable and troublesome, even to convey away to a mill. In this way it was not difficult for a corps marching along the railway to destroy, in a day, ten or fifteen miles of track most completely, and Sherman himself gave close watch to the work to see that it was not slighted. Then all machine shops, stations, bridges, and culverts were destroyed, and the masonry blown up.

The extent of line destroyed was enormous. From the Etowah river, through Atlanta, southward to Lovejoy's, for a hundred miles nothing was left of the road. From Fairburn, through Atlanta eastward to Madison and the Oconee River, another hundred miles the destruction was equally complete. From Gordon, south-eastwardly, the ruin of the Central road was continued to the very suburbs of Savannah, a hundred and sixty miles. Then there were serious breaks in the branch road from Gordon northward through Milledgeville, and in that connecting Augusta and Millen. So great a destruction would have been a long and serious interruption, even at the North, but the blockade of Southern ports, and the small facilities for manufacture in the Confederate States made the damage practically irreparable. The lines which were wrecked were then the only ones which connected the Gulf States with the Carolinas, and even if Sherman had not marched northward from Savannah, the resources of the confederacy would have been seriously crippled. The forage of the country was also destroyed throughout a belt fifty or sixty miles in width.—"*The March to the Sea*," *Jacob D. Cox, LL.D., ch. ii., p.* 35.

MAKING WAR SUPPORT WAR.—But Grant had learned that an army could live without a base ; and now, with a larger army, and for a longer period, and amid ten-fold greater dangers, he put the principle to the test. No army in modern times had ever made a similar attempt.

Napolean, indeed, as he tersely said, made war support war, but it was on a different plan from Grant's. The great Corsican forced the cities and towns that he conquered to furnish him supplies; but he did it deliberately and in advance; he made his arrangements according to a system of forced requisitions, and through the authorities; he never plunged into a hostile region with no more supplies than his army carried in their haversacks. This may indeed have been done for a day or two, on a forced march, or for a special object, but never at the outset of a compaign which was expected to endure for weeks, and in which a force greater than his own was sure to be encountered. Yet such operations were infinitely more feasible in the rich and cultivated plains of Europe, than among the sparsely settled wilds of Mississippi. The people of the country, of course, suffered greatly in this campaign. The system of foraging was very simple. There was no time for elaborate requisitions. Parties of men were dispatched each night, as well as often during the march by day, who scoured the country for miles on each side of the main column of march; these visited every plantation and farmhouse, ransacked every barn, worked every mill, seized every animal; they were always supposed to be under command of officers, but it often happened that squads of men were without this restraint. There was, however, not much time for pillage; the movements were too rapid, and the danger of capture to stragglers too imminent, for any considerable amount of plundering: indeed, the constant motion of the troops gave less time for even the collection of supplies, than might otherwise have been thought indispensable. What was endured was doubtless hard enough, but instances of outrage and insult were rare. The rebels, too, were as merciless in their demands upon the country as the national troops, and lived off the people quite as closely, so that the inhabitants had small choice between friend or foe. They were stripped bare of supplies.—*Badeau's "Military History of U.S. Grant," Vol. I., ch. vii., p.* 291.

The System of Entrenchments.—It is impossible fully to understand the conduct of this campaign without considering the system of entrenching which formed one of its most characteristic features. Other armies in other wars had often entrenched themselves; field fortifications were not unknown before the American rebellion: but the use to which they were put was novel then, although it has since been recognised by European soldiers. The dense forests and abundant undergrowth in America, however, made this use more frequent and indispensable than it can ever be on the broad campaigns where European battles are mostly fought. The woods allowed an enemy to come up close and in force, without giving warning of his approach, and, early in the war, the practice began of throwing up breastworks to protect the army against such advances—advances made more dangerous by the improvement in the manufacture of fire-arms, and the extended range and deadly accuracy they had recently acquired.

A trench, two feet wide and a foot-and-a-quarter deep, could be excavated in twenty minutes, when the men were four feet apart, and shelter was thus obtained for two ranks, one kneeling in the trench, the other lying flat in rear; the slope was built up with clods of earth, fallen trees, and similar material, and a serviceable parapet quickly

formed, with openings through which advances could be made, while outside of all a ditch was dug and an impromptu abatis constructed. When the troops remained in one position for any length of time, these earthworks were elaborated ; lines within lines were built, under the direction of engineers of the regular army, and formidable fortifications arose with curtains, bastions, lunettes, all manned with skilfully placed artillery. But besides these more pretentious works, the troops themselves, finding the great advantage and security to be obtained, soon fell to building up others of their own accord ; and before the campaign was over, a regiment seldom halted for half-a-day without throwing up its own defences towards the enemy. Often this was done without order, and in the midst of battle, if a battalion was for half-an-hour disengaged; and, when picks and shovels were not at hand, the men dug up the earth with their bayonets and threw it out with their cups and split canteens. Sometimes it happened that these rude lines or even the more elaborate works, were stormed by one side or the other, and instantly reversed, and used against those who had constructed them. On the 12th of May, the entrenchments that Hancock carried did far more service to their captors than to Lee.

This system prevailed in both armies and materially modified the character of the fighting. It protracted the duration of the battles, but made them less bloody, considering their length and the numbers engaged. It was, of course, especially favourable to Lee, who was enabled, at all times, to shelter himself, while Grant, always forced to assume the offensive, must always attack works, himself outside of cover. No one can appreciate the difficulties of the national general, nor the advantages of his enemy, or can properly understand the defence that the rebels were able to make against superior numbers, who fails to take into consideration this new and powerful element in the military situation. Grant, it is true, made himself as secure as Lee, and, whenever the rebels attempted an assault, they suffered the disadvantage which their adversaries more often experienced, and their losses were then in a ratio commensurate with Grant's ; but, and this is the gist of the matter, as well as the history of the campaign, Lee did not attack, as a rule, and Grant did ; so that Lee enjoyed the advantages and Grant encountered the difficulties which the new system of earthworks developed.—*Badeau's "Military History of U.S. Grant," Vol. II., ch. xix., p.* 321, *etc.*

The Great Mine Explosion.—At dawn, on the 30th of July, a loud explosion, heard for thirty miles, took place on the lines near Petersburg, and a vast column of smoke, shooting upward to a great height, seemed to indicate the blowing up of an extensive magazine.

Instead of a magazine, it was a mine which had thus been exploded ; and the incident was not the least singular of a campaign, unlike any which had preceded it. The plan of forming a breach in the Southern works, by exploding a mine beneath them, is said by Northern writers to have originated with a subordinate officer of the federal army, who, observing the close proximity of the opposing works near Petersburg, conceived it feasible to construct a subterranean gallery reaching beneath those of General Lee. The undertaking was begun, the earth being carried off in cracker boxes, and such was the steady persistence of the

workmen that a gallery five hundred feet long, with lateral openings beneath the conferates works, was soon finished, and in these lateral recesses was placed a large amount of powder.

All was now ready, and the question was how to utilize the explosion. General Grant decided to follow it by a sudden charge through the breach, seize a crest in rear, and thus interpose a force directly in the centre of Lee's line. A singular discussion, however arose, and caused some embarrassment. Should the assaulting column consist of white or negro troops? This question was decided, General Grant afterwards declared, by "pulling straws or tossing coppers"—the white troops were the fortunate or unfortunate ones—and on the morning of July 30th, the mine was exploded. The effect was frightful, and the incident will long be remembered by those present and escaping unharmed. The small Southern force and artillery immediately above the mine were hurled into the air. An opening, one hundred and fifty feet long sixty feet wide, and thirty feet deep, suddenly appeared, where a moment before had extended the confederate earthworks; and the federal division, selected for the charge, rushed forward to pierce the opening. The result did not justify the sanguine expectations which seem to have been excited in the breasts of the federal officers. A Southern writer thus describes what ensued. The "white division charged, reached the crater, stumbled over the *debris*, were suddenly met by a merciless fire of artillery, enfilading them right and left, and of infantry fusillading them in front; faltered, hesitated, were badly led, lost heart, gave up the plan of seizing the crest in rear, huddled into the crater, man on top of man, company mingled with company; and upon this disordered, unstrung, quivering mass of human beings, white and black—for the black troops had followed—was poured a hurricane of shot, shell, canister, and musketry, which made the hideous crater a slaughter pen, horrible and frightful beyond the power of words. All order was lost; all idea of charging the crest abandoned. Lee's infantry was seen concentrating for the carnival of death; his artillery was massing to destroy the remnants of the charging divisions; those who deserted the crater, to scramble over the *debris* and run back, were shot down; then all that was left to the shuddering mass of blacks and whites in the pit was to shrink lower, evade the horrible *mitraille*, and wait for a charge of their friends to rescue them or surrender."—"*Life of General R. E. Lee*," *J. E. Cooke, p.* 421.

"Raids" in America and in Europe.—"Well may the heart of many a soldier throb, when he reads, how in America great masses of cavalry made marches a week long, through immense tracts of country, over mountain and valley, through rivers and woods. A *raid* means an incursion made by a large mass of cavalry, during which this force is not only made for a time independent of the regular command of the army, but is unable to count upon any daily support from the latter, and is thus absolutely detached and left to itself, while its communications with its own troops are necessarily often temporarily cut by the enemy; being thus situated it proceeds, obeying the good pleasure of its leaders, to execute the duty which it may have been intended to carry out. . . . I cannot possibly accept the conclusion that because raids were possible and useful in America, it must be advisable to employ them in Europe. In the American Civil War of

Secession, as in all civil wars, the population was everywhere divided into parties. The raiding cavalry found friends everywhere, even among their enemies. The means of obtaining news, the care of the wounded, and the subsistence of the troops took quite another character when it was possible to count upon the willing assistance of at least a part of the inhabitants. Moreover, there were large forests in which the cavalry could conceal themselves and march quite unseen. On the other hand, the vast extent of uncultivated tracts of land and the virgin forests made it necessary to ride over enormous distances before reaching the enemy. The whole character of the conduct of the war was different, and that which was good in America might perhaps be only a source of failure in our country."—*Prince Kraft zu Hohenlohe's "Cavalry," Walford's Edition, pp.* 20 *and* 113.

General Sherman's Studies.—When a young officer in Georgia he wrote, "Every day I feel more and more in need of a good atlas; as the knowledge of *Geography* in its minutest details is *essential* to a true military education, the idle time necessarily spent here might be properly devoted to it. I wish, therefore, you would procure for me the best geography and atlas procurable." He also studied, in 1844, "Kent's Commentaries," "Blackstone's Commentaries," "Starkie in Evidence," and similar books, writing, "I have no idea of making the law a profession, but as an officer in the army it is my duty and interest to be prepared for any situation that fortune or luck may offer. It is for this that I prepare."—*Bowman and Irwin's Life of Sherman, pp.* 17 *and* 18.

The Field of Battle of the Wilderness.—General Hancock says of the field of battle of the Wilderness: "It was covered by a dense forest, almost impenetrable by troops in line of battle, where manœuvring was an operation of extreme difficulty and uncertainty. The undergrowth was so heavy that it was scarcely possible to see more than one hundred paces in any direction. The movements of the enemy could not be observed until the lines were almost in collision. Only the roar of the musketry disclosed the position of the combatants to those who were at any distance, and my knowledge of what was transpiring on the field, except in my immediate presence, was limited, and was necessarily derived from reports of subordinate commanders." *Humphrey's, p.* 44.

Spotsylvania—A Desperate Fight.—Brigadier-General Grant of the 6th Corps (Federal) says of it: "It was not only a desperate struggle but it was a hand-to-hand fight. Nothing but the piled up logs or breastworks separated the combatants. Our men would reach over the logs and fire into the faces of the enemy, would stab over with their bayonets; many were shot and stabbed through the crevices and holes between logs; men mounted the works, and with muskets rapidly handed them, kept up a continuous fire until they were shot down, when others would take their place and continue the deadly work. . . Several times during the day the rebels would show a white flag about

the works, and when our fire slackened jump over and surrender, and others were crowded down to fill their places. . . It was there that the somewhat celebrated tree was cut off by bullets, there that the brush and logs were cut to pieces and whipped into basket-stuff ; . . . there that the rebel ditches and cross-sections were filled with dead men several deep. . . . I was at the Angle the next day. The sight was terrible and sickening, much worse than at Bloody Lane (Antietam). There a great many dead men were lying in the road and across the rails of the torn-down fences, and out in the cornfield ; but they were not piled up several deep and their flesh was not so torn and mangled as at the Angle."—*Humphrey's, pp.* 99 *and* 100.

Character of Joseph Johnston.—Johnston was an officer who, by the common consent of the military men of both sides, was reckoned second only to Lee, if second, in the qualities which fit an officer for the responsibility of great commands. His military experience and knowledge were large, his mind eminently systematic, his judgment sound, his courage imperturbable. He was not sanguine in temperament, and, therefore, was liable to lack in audacity. Inclined by nature to a fabian policy, it was a settled conviction with him that, in the existing conditions of the Confederacy, such a policy should be imposed on the most audacious, unless a great blunder on the other side should reveal an opportunity for a decisive advantage. The results which followed a change of policy later in the campaign, go far to justify him in his judgment. Right or wrong, he deliberately adopted a plan of carefully entrenched lines, one succeeding the other, as he might be compelled to retire. He practiced a lynx-eyed watchfulness of his adversary, tempting him constantly to assault his intrenchments, holding his fortified positions to the last moment, but choosing that last moment so well as to save nearly every gun and wagon in the final withdrawal, and always presenting a front covered by such defences that one man in the line was, by all sound military rules, equal to three or four in the attack. In this way he constantly neutralized the superiority of force his opponent wielded, and made his campaign from Dalton to the Chattahoochee a model of defensive warfare.—"*Atlanta*," *Jacob D. Cox, ch. iii., p.* 27.

Field Transport of Sherman's Army.—The field transportation of the army was also regulated. Each regiment on the march was allowed one wagon and one ambulance, and to the company officers of each company was assigned a pack-mule in common for carrying their mess-kit and personal baggage. A similar reduction to the minimum reached through brigade division, and corps headquarters, and the *impedimenta* were everywhere as small as was consistent with the performance of the necessary official work of an army organization. The greater part of all clerical duty was performed at offices in the rear, to which the field reports of various kinds were sent for record and for proper transmission, only the absolutely necessary work being done in the field. The army was thus stripped for its work, and its commander went even beyond what was necessary in setting an example of contempt for personal comfort and convenience, and of the subordination of every other consideration to the single purpose of uniting moiblity with strength in the great army.—"*Atlanta*," *Jacob D. Cox, ch. iii., p.* 23.

SUFFERING OF TROOPS IN EAST TENNESSEE (WINTER 1864).—Until the beginning of March the forces in East Tennessee suffered the extremest want. A considerable drove of live cattle had been collected at Knoxville before the siege, but they grew thin for lack of forage. The country was stripped bare, and during the month of January the cattle that were turned over to the troops for beef were so poor they could hardly stand up. It is literally true that it was the custom of the commissaries to drive the cattle over a little ditch in the field where they were corralled, and those only were killed which could not get over their weakness, proving that it would not do to keep them longer, whilst the others might still last for future use. Indian corn was ground up, cobs and all, for bread. Bran and shorts were diligently hunted and used for the same purpose. The country was scoured for subsistence stores, and nothing but a patriotism equal to that of the troops made the country people patient under their losses and privations. The new year opened with a furious gale and icy storm, which came as a cyclone from the northwest, reducing the temperature suddenly below zero. The half-naked soldiers hovered around their camp fires, some without coats, some without pantaloons, some with tattered blankets tied like petticoats about their waists. An officer passing among them with words of sympathy and encouragement was greeted with the cheery response, "It's pretty rough, General, but we'll see it through!" Even during that fearful time cheers were heard ringing out from one and another of the regimental camps, indicating that the regiment had "veteranized," as it was called when a majority of the rank and file had re-enlisted for another three years, or during the war.—"*Atlanta*," *Jacob D. Cox, ch. ii., p.* 15-16.

RAVAGING GEORGIA.—The great mass of the officers and soldiers of the line worked hard and continuously, day by day, in marching, in bridging streams, in making corduroy roads through the swamps, in lifting the wagons and cannon from mud-holes, and in tearing up the railways. They saw little or nothing of the people of the country, and knew comparatively little of the foragers' work, except to enjoy the fruits of it and the unspeakable ludicrousness of the cavalcade as it came in at night. The foragers turned into beasts of burden, oxen and cows as well as horses and mules. Here would be a silver-mounted family carriage drawn by a jackass and a cow, loaded inside and out with everything the country produced, vegetable and animal, dead and alive. There would be an ox-cart, similarly loaded, and drawn by a nondescript tandem team, equally incongruous. Perched upon the top would be a ragged forager, rigged out in a fur hat of a fashion worn by dandies of a century ago, or a dress coat which had done service at stylish balls of a former generation. The jibes and jeers, the fun and the practical jokes, ran down the whole line as the cortège came in, and no masquerade in carnival could compare with it for original humour and rollicking enjoyment.

The weather had generally been perfect. A flurry of snow and a sharp cold wind had lasted for a day or two about November 23rd, but the Indian summer set in after that, and, on December 8th, the heat was even sultry. The camps in the open pine woods, the bonfires along the railways, the occasional sham-battles at night, with blazing pine knots for weapons whirling in the darkness, all combined to leave upon the

minds of officers and men the impression of a vast holiday frolic ; and in the reunions of the veterans since the war, this campaign has always been a romantic dream more than a reality, and no chorus rings out with so joyous a swell as when they join in the refrain, "As we were marching through Georgia."—"*The March to the Sea*," *Jacob D. Cox, ch. ii., p.* 41-42.

USE OF TELEGRAPH IN AMERICA.—At Mechanicsville, "sitting for hours near the telegraph operator at my quarters, prior to the attack, I listened to the constant and rapid ticking of his machine, and was kept informed, by the various intercommunicating messages at the head-quarters of the army, of the condition of affairs in front of the three corps farthest to the left."—*General Fitz-John Porter.*

THE CONFEDERATE MORGAN'S GREAT RAID.—I left Knoxville on the 4th July 1862, with about 900 men, and returned to Livingstone on the 28th with nearly 1200, having been absent just 24 days, during which time I travelled over 1,000 miles, captured 17 towns, destroyed all the government supplies and arms in them, dispersed about 1,500 home guards and paroled nearly 1,200 regular troops. I lossed in killed, wounded, and missing of the number that I carried into Kentucky, about 90.—*Morgan's.*

MORGAN'S DISREGARD FOR TRUTH.—"On July 15th, Morgan reached Midway, captured the telegraph operator and installed his own operator at the instrument, sent dispatches in the name of the federal generals, and changed the orders for the movement of troops. He telegraphed in all directions, *without the slightest regard for the truth*, and succeeded in creating the utmost confusion and alarm at Cincinnati, Louisville, Lexington, and Frankfort."—*Cist, page* 38.

JACKSON'S MARCHES.—His wonderful celerity of movement was a very simple matter. He never broke down his men by too long continued marching. He rested the whole column very often, but only for a few minutes at a time, and he liked to see the men lie flat on the ground to rest, saying, "a man rests all over when he lies down."—*General Imboden.*

A MASTER OF RUSES.—During Lee's absence north of the Chickahoming, Richmond was at the mercy of McClellan, but Magruder was there to keep up a "clatter." No one was better fitted for such a work. When McClellan landed on the Peninsula he had 118,000 men, and Magruder had 11,500, to cover a defensive line of fourteen miles. But "Prince John," as Magruder was called, amused the enemy by keeping up a "clatter," and, it may be, amused himself as well. No one ever lived who could play off the Grand Seignior with a more lordly air than could the "Prince." During the absence of Lee, he kept up such a "clatter," that each of McClellan's corps commanders was expecting a special visit from the much-plumed cap and once-gaudy attire of the master of ruses and strategy. He put on naturally all these grand and imposing devices which so successfully deceive the military opponent. —*General D. W. Hill.*

FIELD ARTILLERY FIRE.

BY

CAPTAIN W. L. WHITE, R.A.,

(School of Gunnery, Shoeburyness.)

CHAPTER V.

FOREIGN SYSTEMS OF RANGING.—RANGING BY ELEVATING SCREW.—RANGING AGAINST A MOVING TARGET.

The foregoing application of the bracket system, as applied in England and Germany, is extremely simple and therefore little likely to break down; it is accurate but, under certain circumstances, and holding in view the advantage to be gained from a more rapid ranging than that of the enemy, it is considered by some to be too slow. The French and Germans have evolved other methods of using the bracket system in which, although the means employed are in each case similar, there is a difference in the application.

Both these systems are based on the idea that each turn, or fraction of a turn, of the elevating screw gives a certain increase or decrease in the elevation.

German System.—In Germany ranging by means of the elevating screw is only made use of when firing at a moving target; it is only attempted when the detachments are very well trained, and then only at medium and short ranges. It is considered at long ranges that the time gained by the use of the elevating screw is of less importance than at short ranges.

The process is as follows:—All the guns are loaded and laid for the elevation due to the estimated range. After having fired his first round the C.O. gives the word "With elevating screw," and calls out the new elevation. The Sectional Officers repeat the range, and also give the amount and direction of turn to be given to the elevating screw. These corrections are only given in quarter, half, three-quarter or whole turns, according as an alteration of 100, 200, 300 or 400 metres is desired. At medium ranges a quarter turn gives a difference of about 100 metres.

Example.—The C.O. has given 1600 metres as the range, and having fired No. 1 gun and the shell having fallen short, he gives 1800 metres.

The Sectional Officers give "1800 metres; half a turn right." All the guns get the half turn right at once, and all, except the one about to fire, immediately have their sights reclamped for the new elevation and the laying verified by the sight; if there is any pause in the process the gun next about to fire also has its sight corrected.

If this next round was over, the C.O. would give "1700 metres" and the Sectional Officers "1700 metres; quarter turn left," and so on.

All loaded guns make the correction ordered. Any round, the observation of which is doubtful, can therefore be repeated any desired number of times.

Two corrections of this nature are not made consecutively if the elevation has to be altered a second time as, the method being merely approximate, this would entail too great an error. After the first correction the gun must be relaid with the sight and then the second correction may be made. Modifications of the sight are made on the metre scale.

French System.—In France the method of ranging by elevating screw is exclusively employed during the whole of the ranging, whatever the range or target.

To open fire the C.O. orders an elevation less than that necessary for the estimated distance to the target to ensure the first round being short, as these are usually the only ones to be observed, by this means also he will get all the turns of his elevating screw in one direction only. The diminution of elevation depends upon circumstances, but will usually be about 200 metres.

The elevation given, in millimetres of sight, is clamped and is not altered during the whole of the ranging, with one exception given below.

If accordingly the first round is short, the C.O. orders the second gun, then the third, etc., to fire, augmenting the elevation each time by the same amount, until he gets a round over.

NOTE.—The correction ordered is only taken by the gun about to fire, the others remain at the original elevation. This is done to avoid having two consecutive alterations by elevating screw without verification by sight.

This increase of elevation is obtained by a certain number of turns of the elevating screw, the number depending on the distance that the round is estimated short, and also will increase as the difference in range given by one turn decreases. Corrections are generally made of one turn when the range is under 2000 metres, two turns when the range is between 2000 and 4000 metres, and four turns when it exceeds 4000.

If during the operation the C.O. is obliged to make a correction of four turns, he orders it for all the guns laid, and for those not laid a corresponding correction on the sights.

As soon as the target is "long bracketted" the C.O. contracts the limit of the bracket by diminishing progressively the amount of turning of the screw until he has obtained two rounds, one short, the other over, the difference of whose elevation is one-eighth of a turn, this is

the short bracket, and verification takes place on the lower elevation thereof.

When the battery has been ranged the difference between the elevation arrived at and the initial elevation, as expressed by the final number of turns given, is reduced to millimetres of sight, and the sights are then corrected for continuance of fire.

Example.—Estimated range 1800 metres. The C.O. orders for the whole battery the elevation for 1600 metres, viz., 32·5 millimetres of sight.

No. 1 gun.	32·5 millimetres of sight											Short.
No. 2	,,	,,	,,	,,	plus	1	turn	of	elevating	screw.		Short.
No. 3	,,	,,	,,	,,	,,	2	turns	,,	,,	,,		Over.
No. 4	,,	,,	,,	,,	,,	$1\frac{1}{2}$	,,	,,	,,	,,		?
No. 5	,,	,,	,,	,,	,,	$1\frac{1}{2}$	,,	,,	,,	,,		Short.
No. 6	,,	,,	,,	,,	,,	$1\frac{3}{4}$	,,	,,	,,	,,		Over.
No. 1	,,	,,	,,	,,	,,	$1\frac{5}{8}$	,,	,,	,,	,,		Over.

(Commands are given for such amounts as $1\frac{5}{8}$ turns "1 turn, plus $\frac{1}{2}$ turn, plus $\frac{1}{8}$ turn.")

The short bracket is now 32·5 millimetres plus $1\frac{1}{2}$ turns, and 32·5 millimetres plus $1\frac{5}{8}$ turns.

The word of command is now "Guns laid, with elevating screw plus $1\frac{1}{2}$ turns. Other guns, increase the sight by 10·5 millimetres."

The Sectional Officers then give the command for 43 millimetres of sight, which is taken by all the guns.

Advantages of a System of Ranging by Elevating Screw.

a. It is rapid, because after each round observed the following round can be fired after a simple turn of the elevating wheel, which can be done, so to speak, instantaneously.

b. It is easy of application, whatever the number of guns.

c. It can be employed with advantage against cavalry.

Disadvantages of the German System.

a. The use of the elevating screw is based upon an inexact principle, which depends on the admission that one turn of the screw gives a difference in range which is a constant quantity. This constant, fixed at 100 metres per quarter turn, is only applicable to medium distances. Towards the limits of these distances (1000 to 2000 metres) the mean of 100 metres assumed to be given by one quarter turn differs sensibly from the real correction given. It follows, therefore, that when one is obliged to calculate from the result of two rounds, one of which has been corrected by the elevating screw and the other by the sights, great errors may be committed.

b. The system involves, on the part of the subaltern officers, an interpretation of orders instead of a repetition.

c. If the system is to be applied at all it should be suited to all ranges and not merely to medium distances.

Disadvantages of French System.

a. The French take a small bracket of $\frac{1}{8}$th of a turn of the elevating screw, which at different ranges has a varying value :—

At 1000 metres its value is 35 metres.
„ 5000 „ „ „ „ 12 „

Thus at the longer ranges the bracket is less than the 50 per cent. rectangle of the gun.

b. This method is exclusively employed, whatever the range, during the whole of the ranging. The turns and fractions of turns having a varying influence on the range, it is necessary to translate them into millimetres of sight and not into metres of range ; consequently the sight must be graduated in millimetres, which is inconvenient.

c. Only the gun next about to fire takes the correction ordered, so that, if the observation of a round is doubtful, it cannot be repeated without further alteration, which, however, can be made so rapidly that this can hardly be reckoned a disadvantage.

d. It is really only the round that forms the lower elevation of the short bracket that is properly verified, and the only one that the C.O. can be absolutely certain of, as all the rest have been fired after a correction by elevating screw, which is inexact.

The disadvantage of the inexactness of the amount of elevation given by a turn or a fraction of a turn of the elevating screw has been met by the Italians who have placed a small indicator on their carriage which shows the exact amount of elevation added or taken off by each movement. In our service during the past two years experiments have been carried out with several kinds of indicators and good results have been obtained.

It is hoped that we may soon have some form of indicator for the 12-pr., especially for those batteries employed with the cavalry brigades, where rapidity of ranging is of such great importance. The saving of time is about 10 seconds per round, *i.e.*, to take out, reset and replace a tangent scale, and correct the laying, takes on the average 12 seconds ; to correct the laying by means of an indicator on the elevating gear takes on the average two seconds.

There are two other systems which claim our attention ; although they find no present exponents on the Continent, yet they have both been tried and have been for some time adopted before being abandoned.

They are known as the *echelle de distances* or "ladder of ranges," and the *echelon de distances* or the "échelon of ranges."

The ladder system is of great interest, as it is the first attempt at a definite system of fire-discipline, and is the invention of the German Artillery.

The Battery Commander estimated the range and ordered an initial elevation considerably less in order to ensure the first round falling

short. The elevation so given was only taken by the windward gun, the others took elevations each increased by 50 metres. Thus estimated range 2150 metres.

No. 1 gun	elevation		2000	metres.
No. 2	,,	,,	2050	,,
No. 3	,,	,,	2100	,,
No. 4	,,	,,	2150	,,
No. 5	,,	,,	2200	,,
No. 6	,,	,,	2250	,,

If the first round were short the C.O. was able to run rapidly up the scale or ladder, without any pause for alterations of elevation, until he got a round over. The scheme was abandoned, or rather improved away on the following grounds.

1. It required an interpretation of orders on the part of the Sectional Officers.
2. No two guns being laid at the same elevation it was impossible to repeat a round, the observation of which was doubtful, without having to wait until the next gun had made its correction, which also involved a correction, or coming down a step of the ladder, by all the other guns. The German experience of service conditions appears to be that a very large proportion of rounds are not observed, and, therefore, this difficulty of not being able to repeat them readily is insuperable.

In the échelon system, which has been carefully investigated in Belgium as well as incidentally by other powers, only the centre section took the elevation ordered, viz., that for the estimated range, the right section took a certain amount more and the left section a certain amount less; thus, the centre section opening fire, whether the rounds were over or under, the C.O. was always prepared either with the right or left section to go on with the fire without any pause while sights or laying were being corrected.

Example—Estimated range 2400 yards.
C.O. gives "Centre Section 2400 yards; bracket 200."
The centre section takes 2400 yards elevation,
The right section takes 2200 yards elevation.
The left section takes 2600 yards elevation.

If the first rounds from the centre section were short, the C.O. calls out "Left Section," this is also a signal for the right section to shift their elevation three times the amount of the bracket, or to 2800 yards.

This was merely one of the many methods of employing the échelon system, there were several others, but all have been condemned on the same grounds as the ladder system, viz.:—

1. Interpretation instead of repetition of orders.
2. Difficulty of repeating doubtful rounds.

Most of the details of the foreign systems have been taken from Lottin's *Etude sur le Tir d'une Batterie de Campagne.*

Having thus considered the main features of the various systems it

is now possible to get some clear idea of the principles that should not be violated.

1. The system must be simple and should be capable of application without the aid of pencil and paper or note-book, and, if possible, without the aid of a range-table (the latter can be avoided by having every scale on fuze, tangent scale, clinometer, and range-finder, all marked in yards). Complicated systems always break down, or, like the Belgian, which involves the use of note-books and tables of fire and takes two men to carry it out, are inordinately slow at a time when rapidity means salvation.
2. All orders should be repeated and not interpreted.
3. A round, about the observation of which there is the least doubt, should never be taken as a basis for corrections.
4. All guns should take the initial elevation and all alterations ordered in order that a doubtful round may be repeated as often as necessary.
5. To avoid creeping up all alterations both of elevation and fuze should, during ranging, err if anything on the side of boldness.

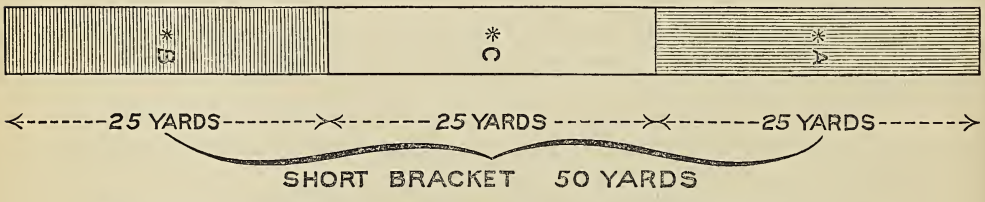
The short bracket having been established, at what elevation should the verifying series be fired?

In the French and German services the verifying series is generally fired at the lower elevation of the short bracket. In our service it is fired at the mean of the two elevations of the short bracket.

The French short bracket is so small that at short ranges almost the whole, and at long ranges more than the whole, of it is contained within the probable rectangle of the rounds fired at this lower elevation.

With the German and accepted English short bracket this is not the case, so we will compare the relative merits of each of the two latter methods of procedure.

As a datum from which to start we will take the 12-pr. B.L. gun. This piece has a 50 per cent. rectangle, the length of which varies with the range from 19 to 31 yards, so, for purposes of investigation, we will take the mean of 25 yards.



Example.—If the short bracket has been established by two rounds, *A* and *B*, 50 yards apart, it is evident that the target may be in any position between *A* and *B*.

If the lower elevation of the bracket be taken for the verifying series the space covered by these rounds will be that represented by

the rectangle *B*, 25 yards in length and of which only 12½ yards lies within the short bracket. Similarly a series fired with the elevation *A* will only cover 12½ yards of the bracket.

But if we take the mean elevation *C* then the space covered by the verifying series will be that represented by the rectangle *C*, 25 yards in length, the whole of which lies within the bracket.

The chances are thus 2 to 1 in favour of elevation *C* enclosing the target in its probable rectangle as against either *A* or *B*.

Again, if the target lay near *A*, a group of rounds fired at elevation *B* would be all short and a second series must be fired at elevation *C*. Of these also too great a proportion would be short and a second correction would have to be made.

Whereas, if elevation *C* be taken as a starting point, if the first series be all either short or over, a single correction of 25 yards will be sufficient to enclose the target, whether it be at *A* or *B*.

This again gives odds of 2 to 1 in favour of elevation *C* as a starting point for the verifying series.

Position of the C.O. during Ranging.

The C.O. should remain on the windward flank of his battery in such a position as will best enable him to observe the effect of his fire. When the importance of this duty is considered, involving as it does accurate observation and mental calculation under difficult and distracting circumstances, the absolute necessity for the relief of the C.O. from all mechanical details, of the punctual performance of which he should be assured by the previous training of his battery, will be understood. For the same reason he should hold himself aloof from his battery and concentrate his attention on the effect he is producing on the target, for it is physically impossible that he can attend to both cause and effect at the same time when they take place almost simultaneously at a great distance apart. A C.O. should never be interfered with or spoken to during ranging, but any message sent to or information required from him should be waited for until after the ranging process is over.

Ranging on a Moving Target.

Practice at a target which is advancing straight towards the battery being the most difficult, it will be sufficient to consider that case only.

Let us suppose that the objective is infantry at a walk, who have appeared in sight about two miles away. The C.O., standing on the windward flank, say the right flank, of his battery, indicates the target and gives the word, "Left Section ranging section; shell. Remainder prepare for shrapnel."

The left section will continue loading with shell without any further word of command.

It is better to fire the first round from the ranging section at a range considerably less than the estimated distance, both in order that the battery may have plenty of time to load with shrapnel, and also that the men may not get the idea into their heads that the target is going at a great pace and therefore they must hurry. If a good long pause is made before the first shrapnel are fired the men have time for

a good look at the target and soon grasp the fact that it is not moving so very fast after all.

The target being about two miles away the C.O. would give the word, "Left Section, 3000 yards." That round being short he would know that the enemy is beyond 3000 yards, he therefore gives "Shrapnel, 2950 yards, Fuze?" It is not necessary for him to repeat the words "Right and Centre Sections" every time; all the battery know that when shell are mentioned the left section is referred to and when shrapnel are mentioned the right and centre sections are referred to.

The C.O., after a pause, fires another round from the ranging section, which is still short. After a further pause he again fires a round from the same section, which is over. He now knows that the target is just within the 3000 yards, and he has his shrapnel ready for 2950 yards, he accordingly gives "Shrapnel, rapid fire from the left of sections; one round;" to this he adds "Ranging Section, 2800," and when the shrapnel have been fired "Shrapnel, 2750, Fuze?" the process is then repeated, the ranging section dropping 200 yards every time.

Supposing the target to be cavalry moving at a trot, the procedure is exactly similar except that all distances are doubled. Thus:— Ranging section 3000 yards; shrapnel, 2900 yards, for the first series, and ranging section 2600 yards; shrapnel, 2500 yards, for the second series, being a drop of 400 yards instead of 200.

When batteries are first being practised at running targets it is sufficient for them to get off one round of shrapnel per gun for every 200 yards that an infantry target advances, but, as the training proceeds, a great deal more than this can be done and three and even four rounds per gun have been got off. Three may be taken as quite sufficient, and the words of command would be as under.

"Left Section, shell; 3000 yards." Short.

"Shrapnel, 2950, Fuze?
2900, Fuze?
2850, Fuze?" — All these elevations and fuzes are given out at once. This presents no difficulty to the memory of subordinates, the gun-layer sees that he has to drop 50 yards each time, he need not, therefore, remember the elevation. The number setting the fuzes has no great strain forced upon him.

All these fuzes are set, the one for 2950 being put into the gun at once.

As soon as the ranging section gets a round over, the word of command is "Shrapnel, rapid fire from the left of sections; three rounds."

After each round the gun-layer drops 50 yards of elevation, and the fuzes being already set the rounds can be fired with great rapidity. Even if the target were to stop while this hail of shrapnel was going on it would not escape, for the depth of ground covered by the bullets would take it in wherever it stood on the 200 yards, at the lower end of which the ranging will be recommenced as in the former series.

In firing at cavalry targets not more than two rounds per gun per

400 yards can be conveniently fired. Thus :—

"Ranging section, 3000 yards.
Shrapnel, 2900, Fuze ?
2700, Fuze ?"

"Ranging Section, 2600.
Shrapnel, 2500, Fuze ?
2300, Fuze ?"

When the target is within about 600 yards the guns should be loaded with case, and the battery should wait until the target gets to within the effective case zone, which will vary slightly according to the nature of the ground.

In the "Instructions for Practice, 1892," a method is laid down, by which a rapid fire of time shrapnel may be continued up to the very moment of the entry of the cavalry into the case shot zone. This is done by causing each gun to be supplied with a portable magazine containing three shrapnel with fuzes set at 2. When used, these shell can be fired with great rapidity, the depth of the cone of dispersion amply compensating for any small error in the position of the burst. They are most effective between 350 and 800 yards.

CHAPTER VI.

Observation of Fire.

This is one of the most important and difficult of the questions under consideration.

It is important because the whole of the ranging, and thus the effect of all subsequent fire, depends upon the correct observation of the ranging shots.

It is difficult because, unlike all other parts of the process of ranging, which can be practised and brought to the greatest pitch of perfection on the barrack square, observation can only be fully exercised when firing with projectiles is actually going on. The amount of ammunition available for any single battery is hardly sufficient to keep those concerned at a high degree of proficiency; everyone should therefore take every opportunity of observing fire, noting his observations and, when possible, comparing them subsequently with the report of the range-party.

It is, perhaps, hardly necessary to dwell upon the fact that anyone trying to observe the effect of fire should be properly equipped, either with field glasses or telescope. Observation with the naked eye is, even at short ranges, generally very inaccurate. (A foreign writer has recently said, from an analysis of many thousand series, that 8 per cent. of rounds are wrongly observed, 23 per cent. are not observed or are marked doubtful, while 69 per cent. are accurately observed. He speaks of ranging rounds only.) Field glasses have the advantage of being very handy, and have a comparatively large field but, if the target is at all indistinct and difficult to pick up when once the eye has been taken off it, it is best to use a telescope on a tripod, which can be

left laid upon the target. The telescope thus laid is also the very best method of pointing out any desired target.

The plan of observation is based upon the peculiarity of the common shell to emit a large cloud of smoke on bursting. If this cloud is observed to obscure the target, the round is short, but if the target is observed to stand out against the smoke, then the round is over. From this it may be deduced that all ranging shell should fall slightly to windward of the target, if the target be a very small one, in order that the smoke may drift across the range and thus facilitate observation. Sectional Officers should see that sufficient deflection is given to their guns to ensure the shell falling to windward. Shell falling to leeward are generally useless for purposes of observation.

Selection of Ranging points. These should be selected with a view of facilitating the observation of the ranging rounds and be, if possible, on the windward flank of the target, or, if the target be a very small one, even beyond the windward flank, but it must be a distinct point or the advantage will be lost. For instance, in firing at a battery, it is usual to range, not on the windward gun, because all splinters passing to the outer flank would be useless, but ON THE GUN NEXT BUT ONE TO THE WINDWARD FLANK but, supposing one of the enemy's central guns were more easy of observation, then that should be chosen as the ranging point because there is still plenty of target to leeward of it to facilitate observation. For reasons to be pointed out under the heading of "Distribution of Fire," it is not generally desirable to range upon a single point if it is possible to observe, with facility, fire distributed over the whole front to be attacked. In firing at such an easy target for observation as a long line of infantry the easiness of observation does not require the concentration of fire upon a single point for ranging purposes, and the line may be attacked along its whole front from the very first.

Accuracy of observation. The degree of accuracy with which the effect of shell may be observed from the battery is, under ordinary circumstances, or at very short ranges, very limited.

Experience has proved that the observation of rounds that strike the target full is only possible under exceptional circumstances, when it is possible to see clearly the effect produced.

If during the ranging a shell *is* observed to strike the target then the elevation of that round should be taken for the verifying series.

Neither is it possible to appreciate the distance that rounds are over or under, except under peculiarly favourable circumstances, such as a target placed on the steep side of a hill or a battery firing from a commanding position. Sometimes, however, a good estimation may be made, *e.g.*, a shell is observed to burst "over" and, after a short pause, some of the smoke passes in front of the leeward portion of the target, a mere glance will show how far the gun smoke drifts in about the same time, that then is the distance of the round from the target. If this require calculation it should not be attempted, but, to a practised observer, it comes as naturally as the proper distance to shoot in front of a driven bird does to a practised shot. The record of the observation of rounds from the battery, should only show the—

Rounds short ... ... [−]
„ over ... ... [+]
„ doubtful ... [?]

Selection of projectile for ranging. When the range is long or the target is at all indistinct then the forged steel common shell, on account of its large bursting charge and consequent large cloud of smoke, is invaluable; but, as pointed out before, its man-killing properties are beneath contempt. Whenever, therefore, local circumstances render the observation of percussion shrapnel possible then that projectile should be employed for ranging purposes.

Difficulties of observation and the means of overcoming them. These difficulties are numerous and will be discussed under their different headings as follows:—

Personal difficulties. Bad or failing eyesight. Want of training.
Smoke. Our own. That of the enemy.
Projectiles. Our own. Those of the enemy.
Formation of ground and position of enemy with regard to it.
Light. Mirage.

These difficulties cannot be spoken about without mentioning also many that are equally incidental to laying, the remarks made about the one may therefore be taken as, in a great extent, applying to the other. The difficulties about to be set forth being sufficient sometimes to almost paralyse the artillery, they are worthy of the most careful study, and this not alone by the officers concerned in the technical administration of fire, but also by the Brigade Division Commanders and the higher artillery leaders, for it will be shown that, by the action of these latter only, in the placing of the batteries and, in some cases, by their special initial orders as to the regulation and succession of the fire in the batteries under their commands, that observation and laying is made easy, or even possible. It will be impossible to set forth every combination of wind, light, ground, etc., that may arise, but the general remedies for each class of difficulty will be given.

Personal difficulties. These may arise from failing or defective eyesight, and the only remedy is to have a trained observer to assist the Battery Commander.

If a trained observer is employed implicit reliance should be placed in him, and it is better that the Battery Commander should not look at the target at all; if differences of opinion arise, which cannot, as on the practice ground, be decided by the range party, they only cause both parties to distrust their own and the others powers of observation. An officer, especially if he be a sportsman with a good eye for country, almost invariably makes a better observer that a non-commissioned officer or gunner, as his education enables him to grasp more quickly some new combination which may not have occurred in his experience before.

The observing party mentioned in Vol. II. of "Field Artillery Drill" (q.v.) is generally only possible when a single battery is in action and, as this can only happen in exceptional cases, Commanding Officers must not get into the habit of trusting to observing parties for the corroboration of their own observation.

At practice camps it is often possible to send two or three good

observers some weeks in advance of the battery, who thus get the advantage of the observation of a considerable amount of fire before their talents are called into practical requisition with their own batteries.

Difficulties arising from smoke.—Our own. There is no doubt than an easy solution of our difficulty lies in the adoption of a smokeless powder, but, as black powder is still to be met with, we must be prepared to accept and combat the conditions incident to its use.

First, we have the case when, in a side wind, the smoke of the windward batteries drifts across the front of the leeward batteries and obscures their view. In this case it is as well, if the ground permit, to push the leeward batteries slightly forward, a very few yards is sufficient, so that the smoke from the others will drift behind them. If, however, it is not possible to place the batteries in échelon the following plan may be resorted to. Divide the mass of artillery into pairs of batteries, making the space between each pair as great as possible, at the expense of the gun and battery intervals. The guns should be fired by rapid fire (seven seconds interval) from the windward flanks of each pair of batteries right through both batteries. The amount of fire thus obtained is exactly the same as if each battery, on its own account, were firing ordinary fire with 15 seconds interval. If a Brigade Division of three batteries is ordered to fire in succession in this manner, then the same amount of fire is obtained as if each battery were firing, on its own account, ordinary fire with 20 seconds interval.

Foreign experts say that this method of fire is efficacious at times, but cannot be applied to large masses of batteries without sub-division.

Next, if the wind be blowing from behind, a great cloud of smoke will hang in front of the line of batteries and gradually drift down the range towards the enemy. Difficulties of laying must, of course, be met by the use of auxiliary laying points, but a small clear space for observation may sometimes be obtained by increasing the space between the batteries.

In giving this increased space between the batteries the greatest care must be taken that the normal front occupied by a Brigade Division is not exceeded, the battery intervals must, therefore, be increased at the expense of the gun intervals. The reasons why this front must not be exceeded are :—

a. To keep the Brigade Division within one man's command.

b. In a great modern battle the space for the deployment of artillery is limited as compared with the number of guns employed. If, therefore, batteries of a Brigade Division are too widely interspaced and the whole Brigade Division occupies more than its fair share of the available front, then batteries of other Brigade Divisions will, for want of space, infallibly be pushed in between them, and the unity of the commands will thus be destroyed.

These increased spaces between batteries have the further advantage that space is given on the flanks into which the limbers can be withdrawn from the fire directed on the guns.

If two batteries are simultaneously engaging a target and are inconvenienced by one anothers' smoke, and if neither of the above remedies is possible then it would be advisable to cease firing with the two contiguous half batteries of the centre and continue ranging with the two outer half batteries, a large interspace between the guns firing is thus secured. After the ranging, when accuracy of observation is not of such great importance, the temporarily silent guns would resume their fire, being layed by means of auxiliary laying points. The same remedy applies to larger bodies ; if any batteries of a line are to remain temporarily silent to facilitate observation of others it must be those of the centre. The question of the number of batteries to range at the same time is discussed on page 272.

It will be seen that most of the difficulties arising from our own smoke are to be met by action taken by the Commanders of the Brigade Divisions ; and in the selection of a position the direction of the wind should be carefully noted, and the placing of the batteries with reference to it and the succession of their fire be closely considered before they are actually placed upon it.

Flank from which fire should commence. Under the head of difficulties arising from our own smoke it will be as well to discuss the question of the flank of the battery from which fire should begin in order to avoid the difficulties of laying arising from smoke. With the wind either up or down the range it is immaterial from which flank fire is opened, but with a side wind we have a choice of commencing either from the windward or the leeward flank.

The leeward flank is always chosen when firing at a moving target, because the smoke drifting in front of the guns that have just fired, those about to fire can follow the object over the sights up to the moment of firing. When a strong breeze is blowing fire may also be opened from the leeward flank against a standing object, but it has been pointed out that heavy and continued firing, such as that in a general engagement, has the effect of deadening the wind, and that most often one has to deal with gentle breezes ; in this case, the target being a standing one, it is immaterial that the sights be kept upon the object until the last moment, but it is material that it should be possible to relay the guns immediately after firing. Therefore with a gentle wind for rapid firing against a standing target (such as the fire at the critical moment of the artillery duel) it is better that the succession of fire should be from the windward towards the leeward flank.

To avoid complications the rule may be summarised :—

Fire is to be opened from the leeward flank against moving targets, and from the windward flank against standing targets.

Difficulties arising from smoke.—That of the enemy. This is a condition which we cannot do away with unless the enemy has also adopted a smokeless powder.

If we can once get the range, the continuation of fire by means of auxiliary marks is comparatively easy, but if the target is invisible from the first another difficulty is presented. We have two alternatives :—

a. To find the range and concentrate our fire on the windward

portion of the enemy's line (in the case of a side wind this will not be obscured by smoke) and gradually silence each portion of his line in succession.

This plan presents the great disadvantage that while we are so engaging a small portion of the enemy's line the remainder is able to carry on its practice almost under peace conditions, while ours cannot fail to be seriously disturbed by the fire thus delivered.

b. In the case of the wind blowing straight from the enemy towards us his smoke will drift in our direction in a vast cloud which will entirely veil the whole of his front and there will be no indication how far in rear of that veil his batteries are posted. Our only chance is to find the range of the edge of the cloud nearest to us; this will probably have to be done by salvos of batteries as single rounds would be quite lost in the smoke. Having found the range of the edge of the cloud a salvo of time shrapnel should be fired for that range; the elevation is then raised 100 yards with fuze to correspond and another salvo is fired, and so on until the ground behind the curtain of smoke is swept to the depth of 500 to 600 yards. The process is then reversed until we return to the original elevation and fuze. This sweeping backwards and forwards must be continued until a cessation or slackening of the enemy's fire tells us that we have got his range, and it is for the purpose of making this disturbance in the enemy's fire more apparent that salvos, otherwise so rigorously tabooed, are fired.

This method of attack being the only one ever suggested for the attack of an enemy concealed either behind smoke or more material cover which is not accessible to us and therefore against whom observation is impracticable, is worth study.

Difficulties arising from the number of projectiles.—Our own. When a number of shell are falling about the same spot at the same time during ranging, the Commander of any particular battery will be very puzzled to distinguish his own from those of other batteries.

To minimise this difficulty must be one of the special cares of the Officer Commanding the Brigade Division.

a. By carefully pointing out the portion of the target upon which each battery of his command is to fire and, without interfering too much with the Battery Commanders, seeing that their respective ranging points do not clash with one another.

b. If the target is a small one and he intends to bring several batteries to bear upon it, by only ranging with the same number of batteries as he can select ranging points on the target. The others accept the range when found and join in the fire. It is evident that these latter batteries can verify the range for themselves by a few rounds, for the original batteries have already passed to time shrapnel fire and their shell bursting in the air cannot be confounded with those bursting on the ground.

In this case, if it be possible, it would be as well to bring all the batteries into action at once. Those not immediately firing at the objective could be employed in picking up the range to other points which will probably be occupied by the enemy during the course of the fight or, if they are compelled to remain temporarily silent, could be occupied in taking up auxiliary laying points and be prepared, on having the range communicated to them, to open an annihilating fire. Their position might not be disclosed until they opened fire, but, even if it were, it is not likely that the enemy would divert his attention from those batteries which were already annoying him.

If several batteries are brought into position at once against a small target it will generally be the duty of those batteries on the flanks to find the range for the others. These batteries are selected because, on account of the large space between them, they are less incommoded by smoke.

When one side possesses a superiority of numbers it is customary to keep the battery on each flank firing percussion shell, both in order to facilitate observation and that they may always be ready at once to find the range to a new objective for it is on the flanks that new objectives, especially cavalry, generally appear.

Difficulties produced by the number of projectiles.—Those of the enemy. These difficulties are only met with on the battle-field itself, but still preparation may be made in time of peace to combat them.

Perhaps the greatest disturbing element is the hurry, forgetfulness, general slackness and, to call it by its right name, funk, produced by the moral effect of shell bursting in and around the battery or singing overhead, and the sight of dead and wounded comrades. This can only be overcome by the strictest "Discipline under Fire," and, as pointed out in Chapter I., by means of a long and strict course of pure gun-drill on the barrack square, which will teach men to perform almost mechanically even under the greatest mental exhaustion, the purely mechanical functions of loading and laying.

To meet the actual loss of men the following precautions should be observed in training :—

a. Every officer of the battery should be able to take the place of the C.O.

b. There should be a sufficient reserve of trained layers, say 18 per battery.

c. "Casualties" should constantly be given at drill.

d. The verified range should be registered in chalk on the trail of the gun, and the verified length of fuze on the back of the limber or wagon. Thus, if the gun-layer or No. 5 is killed his substitute knows at once how to proceed.

e. As soon as possible the gun-layer should allow the numbers at his gun, commencing with No. 2 who assists him in laying, to look over the sights and become acquainted with the target.

By the above means only can the *personnel* of a battery be prepared at all times to successfully carry on the fire under the most adverse circumstances.

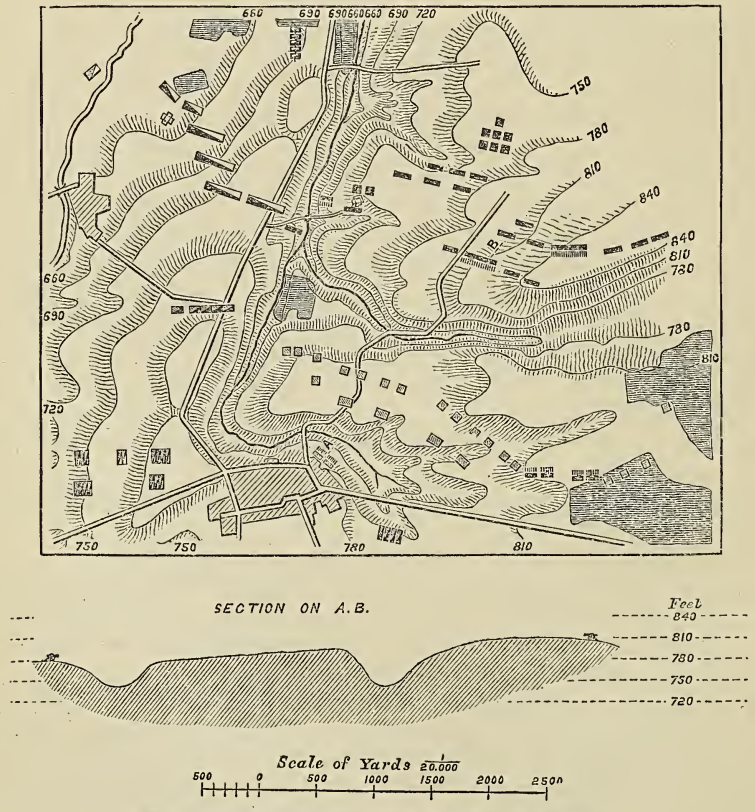
Difficulties arising from the nature of the ground and the position of the enemy. Great inconvenience will be felt if the enemy's guns or batteries be placed in échelon, as it will render the observation of some of the rounds very uncertain. Moreover, we shall not be able to distribute our fire without further corrections, and shall not be able to shift the fire from one portion of the target to another without further ranging. A good tactical *coup-d'œuil,* a sportsman's eye for country, and careful ranging are the only remedies for this.

Marshy ground either in front or rear of the target often hinders observation by smothering the ranging shell; this difficulty can only be got over by the use of a comparatively large number of common shell and the very careful location of the target by firing two or more verifying series at different elevations within the short bracket.

But the greatest difficulties arise when the enemy is posted in rear of a hollow into which our shell drop; the smoke of the bursting shell rising and growing thinner as it rises the target is seen through it, and the round has the appearance of being over thus giving rise to serious errors.

The accompanying sketch shows a section of the ground between

MARS-LA-TOUR, AUGUST 18TH, 1870.



Horizontal scale of Section is double that of the Plan.

the French and German batteries at Mars-la-Tour. The latter, at A, were completely puzzled by the ravine in front of the French position. This ravine is not visible from the German position, and the first shell falling near the far edge of it obscured the French guns and were rightly judged short, further shell fired with the same elevation fell right down into the steep-sided ravine, and the smoke rising up and growing thinner, the French guns were seen through it, and the rounds were erroneously judged over; the range of the ravine was thus accepted as the correct range of the guns although the latter stood several hundred yards in rear of it. In Prince Kraft's "13th Letter on Artillery" he mentions other cases where optical delusions have prevented correct observation and the subject is a most important one, because unless we have a full grasp of it we shall never be able to take full advantage of the concealment offered by the formation of the ground. This subject is of such importance that it is referred to again at the end of this Chapter, under the heading "Concealment *versus* Protection."

Difficulties arising from light, background, mirage, indistinctness of target, &c.—Light and background. The combinations offered by these are almost innumerable, but generally speaking when the target is indistinct in a bright light occasional glimpses of it may be obtained when clouds pass over or as the smoke of the enemy's fire rises and veils the sun. Whenever possible the position of the target should be registered by means of auxiliary marks the same as for laying, and every time it re-appears these should be corrected if necessary.

With a dull light the same precautions should be taken, and advantage taken of bright flashes emanating from it to register the position of the target.

It is under conditions such as the above that a telescope on a tripod is invaluable as it can be left laid upon the target.

Mirage.—In this case the target should be treated as if it were altogether an unseen object and the guns should be laid by means of auxiliary marks. The fire may often be observed from the nearest high ground or from a tree conveniently near the battery; it is not always necessary to go to any great elevation in order to be able to observe and in minor cases it is sufficient to stand upon a limber in order to see the target plainly.

Indistinctness of target.—This is a difficulty that we are likely to suffer from very much in the future owing to the introduction of smokeless powder. If the target itself is hardly visible the only way out of the difficulty is to register, by means of auxiliary marks, the position of the bright flashes occasionally emanating from it. If it is not known where to look for these, the furrows made by the enemy's shell and bullets will show the direction from which the fire is coming and it will not then be difficult to locate the position of the target.

Concealment versus Protection. A consideration of the points put forward in this Chapter cannot but impress the fact of the great benefit to be derived from selecting such a position that the enemy's observation, and therefore ranging, shall be rendered as difficult as

possible. If once the range of a target is accurately known then the total destruction of that target is merely a matter of time, in spite of any protection it is probable that one will meet with in the field; our great object then should be to prevent the enemy ever finding the range or at least so to delay him that we shall do so first. The following example will be a sufficient illustration.

At Okehampton in 1890 the target guns placed in the open were placed so as to take full advantage of the concealment offered by the irregular nature of the ground and incidents such as that mentioned as occurring at Mars-la-Tour were of not infrequent occurrence. The losses suffered by the detachments of these batteries were, taking the average of many series, 30 per cent. of the whole strength. When guns in pits were fired at these, pits were generally placed in such positions that the ranging was comparatively easy, and the losses suffered by the detachments amounted to 36 per cent. Of course, if the guns in the first case had been protected as well as concealed the losses would have been still less; for instance, during the practice of the same year the average losses of infantry well out in the open was 47 per cent., while the infantry in well-placed shelter-trenches was only 27 per cent.

The greatest misuse of what might afford sufficient concealment is most often made in the case of batteries coming into action behind hedges and low banks. If, as is usually the case, the battery comes into action immediately in rear of the hedge or bank it is an extremely easy object to range upon, as the dark line of the hedge greatly facilitates observation, but if the battery is brought into action some 250 to 300 yards in rear of the hedge and thus uses it as a screen, then the enemy will be puzzled to know its exact whereabouts, and will most probably range first on the hedge, and perhaps continue his fire on that point. The proper way to attack a battery so posted is to find the range of the screen and then sweep backwards and forwards with time shrapnel fire until the target is found, as mentioned on page 272. It is certainly laid down in the drill-book that a screen to be of use should be at least 200 to 250 yards in front of the battery but, as the reason for it is not generally understood, the regulation is often contravened and batteries turn a screen which would afford excellent concealment into a cover affording but inadequate protection.

SUCCESSION LIST

OF THE

MASTER-GUNNERS OF ENGLAND.

BY

MAJOR R. H. MURDOCH, R.A.

(Assistant Superintendent R.A. Records).

PART II.

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
James I. (*Contd.*)	1611	William Hammond. (*Contd.*)	1620. Nine "Gentlemen of the Ordnance" appointed. 1621. *The Master-Gunner of England* was included with the Train to accompany the army and artillery for the Palatinate, with special field pay of 6s. *per diem*.
			1629. Siege of Bois le Duc } Under the 1632. " Maestricht } Prince of Orange.
	1623	John Reynolds (Reynold or Reignolds.)	1630. Lord Vere of Tilbury appointed *Master-General*. The Board of Ordnance put into commission. In the Cleaveland MSS., p. 32, "John Wornn, Esquire, an experienced soldier, a Scotchman by birth," is stated to have become *Master-Gunner of England*, in succession to John Reynolds ; but this is incorrect. The Royal Warrant, 8th, of William and Mary, in

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date o Appt.	Name.	War Services, &c.
James I. *(Contd.)*			appointing Captain Richard Leake to the office, recapitulates the continuity of succession of his predecessors (*since Statute of Monopolies*) as Fenrutter, S. Bull, W. Bull, Hammond, Reynolds, J. Weymes, and Capt. Valentine Pyne. There is not any Royal Warrant, nor other document, to be found which mentions John Wornn.
Chas.. I. 1625–1496	1638	James Weymes *(Royalist)*	1635. Monntjoy, Earl of Newport, *Master-General.* (The Board of Ordnance still in commission). 1639. The *Master-Gunner of England* took the field against the Scotch (pay at 6s. 8d). 1642. In the Royalist Train of Artillery, at the battle of Edge Hill, the Deputy of the *Master-Gunner of England* was Wm. Betts. In this year the Master-General was styled *Governor and General of the Ordnance* (Sir Timothy Tyrell), and the Earl of Peterborough was appointed *General of Artillery.* Shot picked up on the field (Edge Hill) are still in the possession of the tenant of the farm whose family have held the farm ever since 1642.[1] 1644. Pressed by the Parliamentarians in the battle of Compredy Bridge, the *Master-Gunner of England*, Jas. Weymes, was taken prisoner. At the Restoration (1660) he was re-appointed to his office with rank of Colonel.
Interregnum	1645	*Master* Francis Furvin. *(Parliamentarian.)*	Appointed *Master-Gunner of the Field* to Cromwell. 1649. Richard Woollaston, as *Master-Gunner of England*, appointed by the Committee for the National Safety, and in 1650 Major-General Harrison, as *Lieut.-General of the Ordnance.* N.B.—Of the ordnance captured in Stirling Castle by Cromwell's *Lieut.-General of the Ordnance* (Colonel Moncke) 11 were leather guns. The honorable loyalty, tact, and quiet dignity of the Ordnance Officers in the Tower of London, during the distracting crisis between the King and the Parliamentarians, are finely depicted in the following petition which
	1649	Richard Woollaston.	

[1] According to letter from C. J. Ribton Turner, Esquire, the historian of Warwickshire.

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

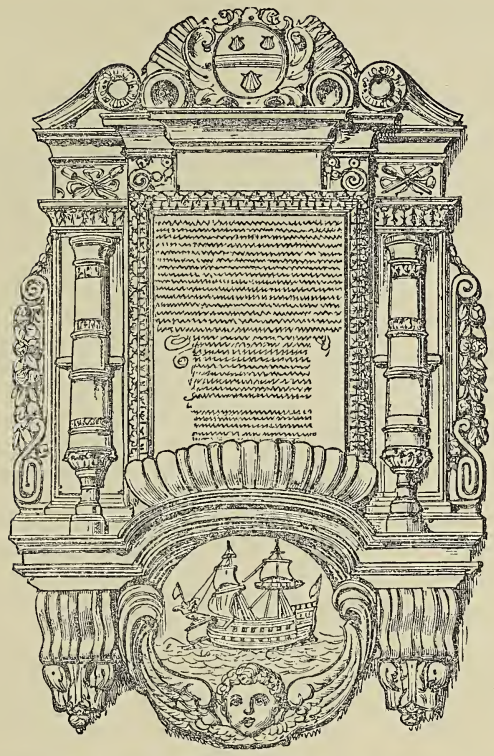
Reign.	Date of Appt.	Name.	War Services, &c.
Interregnum *(Contd.)*			they presented to Parliament while prisoners for having refused to issue to the Parliamentarians ordnance and equipments entrusted to them under their oath of fealty to the King:— "The humble petition of Captain Francis Conningsby, Richard March, and Edward Sherburne, Officers of his Majesty's ordnance, shewing,—That whereas your Lordships' petitioners have been divers days under restraint by your Lordships' command for not giving consent to the issuing of some munition in their custody, the petitioners humbly pray that your Lordships will be pleased to take into consideration:— (1) That they are strictly bound, by the duty of their place, not to dispose of the munition in their custody contrary to his Majesty's pleasure. (2) That before the petitioners received any commands from the right honorable the Earl of Essex, his excellency, for the delivery of the munition in the warrant expressed, the petitioners received strict command, under his Majesty's sign manual, not to issue out any munition without express warrant from his Majesty. (3) That the petitioners have, these four years and-a-half, been unpaid the fees and allowances belonging to their places. Therefore, their humble suit is that, in regard to the giving of their consent to your Lordships' commands in this particular, would not only be a great breach of trust in them, but tend to their undoing; that your Lordships would be honorably pleased to accept of their willingness and cheerfulness to obey your Lordships' commands, so far as may stand with their own integrity and safety, and that your Lordship would be pleased to release them from their present restraint whereby they are put to great charge and suffer much in their own private occasions. And your petitioners shall ever pray for your Lordships. (Signed) Francis Conningsby. („) Richard March. („) Edward Sherburne. It is ordered, by the Lords and Commons

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Interregnum *(Contd.)*			in Parliament assembled, that the Officers of the Ordnance in the Tower of London shall forthwith, upon sight of this order, deliver the keys of the office of the ordnance, arms, ammunition, and stores there, to such as the committee for the defence of the kingdom shall appoint to receive them; or else that the doors of the said office shall be forthwith broken up, and the charge and keeping of the said arms shall be committed into the hands of such as the said committee shall think fit—who shall take inventories of the same, to the intent that a true account may be taken of the said arms to the use of his Majesty, the Parliament, and the kingdom."[1]
Chas. II. 1660-1685	1660	*Colonel* James Weymes (*re-appointed*).	At the Restoration, Sir William Compton was appointed *Master-General of the Ordnance*, with the celebrated Colonel Wm. Legge of the Artillery as his *Lieutenant*. The assigned grounds for re-appointment of Colonel Weymes as *Master-Gunner of England* were his services during the late wars of Charles I.
	1666	*Captain* Valentine Pyne.	War services recorded on tablet subjoined. Had been appointed Master-Gunner (from Gunner) in 1663; appointed *Deputy-Master-Gunner of England* in 1665 (probably owing to the great age of Colonel Weymes). The grounds for his appointment were also his services in the wars of Charles I. His brother, *Richard Pyne*, was appointed Master-Gunner of Gravesend on 31st October, 1673: and his father was also an Officer of the Ordnance. Like his predecessor, William Hamond, Captain Pyne had amassed much wealth during his tenure of high office. The exceptional esteem, services, and reputation attaching to this ubiquitous representative of the *Ubique* corps are marked on the magnificent marble tablet still existing on the north-east wall of the Royal Chapel in the Tower of London, erected to his memory alone of the Master-Gunners of England.[2]

[1] At this date Ordnance Officers were styled *Officers of Thordinances*, as appears in the book temporarily used for record of the issue of guns and warlike stores under orders from the Parliamentarian General.

[2] Prepared from a photograph taken in the Tower Chapel by Bombardier Andrews, of the R.A. Record Office, by special permission of Lieut.-General Milman, C.B.



" Erected in memory of Captain Valentine Pyne, late Mr.-Gunner of England " second sonne of George Pyne of Currymallett, in ye County of Somerset, Gent, " who following ye footstepps of his Father and in loyale obedience to his " Sovereigne trayled a Pyke under the command of his Father in ye last expedi- " côn at Cadis in ye year 1625 and ye year 1627 in ye expedicôn at ye Isle of " Rhe after that betook himself to his Mat^ies Fleet where hee served at sea till " the late unhappy Rebellion, and during that Rebellion in his late Mat^ies service " at land. After whose death hee voluntaryly followed ye command of Prince " Rup. for ye space of XV yeares. Both in his expedicôns at sea and in ye warrs " of Germany, till his now Mat^ies happy Restauracon since W^ch tyme hee com- " manded some of his now Mat^ies shipps in the first warr against ye Dutch and " in Recompense of his faithful service his Ma^tie was graciously pleased to elect " him Mr.-Gunner of England in w^ch capacity hee departed this life (w^ch hee " ledd single) the last daye of Aprill Anno D^ni 1677 and in ye XXVIII^th year of " his Majesties Reigne aged 74 years.

V ndaunted Hero whose aspireing mind
A s being not willing here to bee confind
L ike birds in cage, in narrow Trunk of Clay
E ntertained Death it soard away
N ow hee is gone why should I not relate
T o a future age his Valour, Fame, his Fate
I ust, Loyal, Prudent, Faithful, such was hee
N atures accomplished worlds Epitomie.

P roud hee was not and though by Riches tryd
Y et virtue was his safe his surest guide
N or can devouring Tyme his rapid Jawes
E re eat away those Hxioms hee made Lawes."

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Chas, II. *(Contd.)*			1670. Sir Thomas Critcheley appointed *Master-General of the Ordnance*, and in 1678 Sir Thomas was appointed also Master-General of the Ordnance in *Ireland*, with other pluralities.
	1677	*Captain* Richard Leake.	Captain Leake was Master-Gunner of H.M.S. *Speedwell*, and transferred to the *Princess* (a fourth-rate, of 52 guns) in October 1664. Appointed Master-Gunner of Fort Gillingham (Kent) in 1672. The grounds assigned for his preferment as *Master-Gunner of England* were his "good service during the warr with the French, Deane, and Dutch, by sea and land." In 1678 Colonel George Legge (afterwards Lord Dartmouth) was appointed "General of the Artillery" with the army in the Netherlands; but the *Master-Gunner of England* does not appear in the details. In 1682 Colonel Legge (then Lord Dartmouth) became Master-General of the Ordnance (he had been *Lieutenant of the Ordnance* since 1679): and his first effort, in conjunction with Captain Leake, was to bring all the Master-Gunners of Great Britain under the direct authority of the Master-General of the Ordnance (instead of under the Master-Gunner of England), a course which continued until 1855, when the Board of Ordnance was abolished. Since 1859 the Master-Gunners have been incorporated into the Coast Brigade (now called "District Establishment"). 1682. A residence at Woolwich (in the "great house"—now the model room, Laboratories, Royal Arsenal)—was provided for the *Master-Gunner of England*, and a stable for his horses. 1683. Functions of the Master-Gunner of England further defined; and his pay raised to £190 per annum. At this time one of the sons of the Master-Gunner of England (John Leake) was appointed one of the Master-Gunners attached to Regiments with battalion guns (instituted by Charles II.): and he subsequently became one of the three deputies or "mates" to the Master-Gunner of England. On 24th December, 1714, Richard Leake, son of John, and grandson of the Master-Gunner of England, was warranted Master-Gunner's mate (*i.e.*, Deputy of the Master-Gunner of England).

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
James II. 1685-1688			1685. John Fawcett, appointed Deputy of *Master-Gunner of England* at 5s. for field service train.
Wm. and Mary. 1689-1702			1688. The *Master-Gunner of England* (Captain Richard Leake) took the field against William of Orange: and this appears to have been the last occasion of the Master-Gunner of England being employed in such capacity on active service in the field. The *Master-Gunner of England* was included in the train of artillery, 1691, to accompany Marlborough's army to the Continent; but he was omitted from the revised details of the train actually embarked in 1693, probably on account of his advanced age, but three deputies or "mates" to the Master-Gunner of England were on this occasion provided, with extra pay of £45 each per annum, viz.:— Mr. John Leake, Master-Gunner (son of the Master-Gunner of England), who remained at home. Mr. Thos. Dodge, Master-Gunner, who embarked with the artillery train of Marlborough's army in 1693 (promoted "Gentleman of the Ordnance" in 1696 for distinguished services). Mr. Thomas Silver, Master-Gunner, who embarked 1693 "to attend the bomb vessels" (promoted *Captain* for distinguished services, and subsequently became *Master-Gunner of England*). 1689. Frederick, Duke of Schomberg, appointed Master-General of the Ordnance. The Duke was killed in the battle of the Boyne; and was succeeded as M.G.O. by Henry, Viscount Sydney, who was in turn succeeded, in 1694 by Henry, Earl of Romney. 1696. Captain Richard Leake, *Master-Gunner of England*, died at Woolwich; and was buried in Woolwich Church.
			The Master-Gunnership of England now enters a new phase by becoming a substantial *honorarium* holden by an Artillery Officer of high rank in addition to the pay and allowances of his army rank—a precedent, which

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Wm. and Mary *(Contd.)*			has continued to the present day, with the one exception of Captain Thomas Silver (for whom the distinctive appointment of *Master-Gunner of England*, without other office, was revived in 1702). Hitherto this ancient and honorable post — the *primus ordinatus* or senior grade of Artillery—had been conferred upon a Master-Gunner, by selection, for distinguished services, who had graduated from Gunner. *The old order now changes,* *Giving place to new.*
	1696	*Lieut.-Col.* George Browne.	The venerable incumbent of the office (Captain Leake) had remained in England, and although represented on land and at sea by his deputies, Master-Gunners Dodge and Silver, Lieut.-Col. Browne was *de facto* the Master-Gunner of England with Marlborough's army, and his artillery had developed and become distinguished beyond all precedent (so many as 120 pieces of cannon and mortars having been directed by him alone at the siege of Huy). The Duke of Marlborough therefore secured the nomination of his senior Lieut.-Colonel Commanding the Artillery; and the Royal Warrant of 20th October, in the eighth of William and Mary, in reciting the incumbents of the office (since temp. Henry VIII.), conferred upon Colonel Browne the "power and emoluments" enjoyed by his predecessors. Although described in the Royal Warrant merely as *George Browne, Esqre.*, the new incumbent was the Artillery Lieut.-Colonel (since 1691): in 1700 Lieut.-Colonel Browne's pay with the Train is recorded as £300 per annum, and in the quarter-books for 1700 as *Master-Gunner of England* at £190: in 1702 he was promoted Colonel from 1 April, 1702, at £1 5s. per diem., and would appear to have died in that month.
Anne. 1702-1714		*Captain* Thos. Silver.	The last of the Incas! Captain Silver was originally appointed *Gunner* on 4 Oct. 1663; promoted *Master-Gunner* about 1670; *Chief Master-Gunner of the Fleet*, with the bomb vessels ordered with the expedition to Flanders in 1693; in 1696 promoted deputy or "mate"

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Anne. *(Contd.)*			to the M.G. of E.; and *Master-Gunner of England* in April 1702, vice Colonel Browne, for good services by land and sea. Captain Silver died in 1710, and lies buried in Shafwich Church, Somersetshire. The late Lieut.-Colonel A. Warry, when D.-A.-A.-G., discovered this, and kindly communicated it to me. 12th May, 1702. Earl of Marlborough appointed *Master-General of the Ordnance.*
	1710	*Colonel* James Pendlebury.	Col. Pendlebury's appointment as *Master-Gunner of England* at 2s. per diem. and allowances, is dated 29th November. His services had been exceptionally distinguished with Marlborough's army. Col. Pendlebury was *Comptroller* of the first permanent Train of Artillery on 1st May, 1698 (of which Lieut.-Colonel George Browne was Colonel, and Captain Albrecht Borgard, Adjutant), and was then styled "Mr.," third in point of seniority in the Train. He embarked for Holland in 1702, as *Comptroller*; in 1706 was appointed "*Chief Firemaster;*" in 1708, *Second Colonel and Comptroller* in Holland; November, 1709, *Master-Gunner of England;* December, 1709, *Colonel* of Royal Artillery in the Low Countries; 1711, *Second Colonel and Comptroller* in Flanders; and in 1715 was placed on half-pay at £1 12s. 6d. *per diem.*
Geo. I. 1714-1727			1712. Richard, Earl of Rivers, appointed *Master-General;* 1712, succeeded by James, Duke of Hamilton. 1714. Duke of Marlborough re-appointed *Master-General.* 1715. Major Bousfield, "Mate," or Deputy, to the *Master-Gunner of England* to have the care and command of the two companies of gunners and matrosses quartered at Deptford and Woolwich; and that every Saturday at three o'clock in the afternoon, "they be mustered and paid at the gun shedd on Blackheath." Major Wm. Bousfield was the last survivor of the three "Mates" or Deputies of the Master-Gunner of England. He died

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Geo. I. 1714–1727 (*Contd.*)			at Greenwich, 4th December, 1736. His obituary records that "he behaved with great gallantry in King William and Queen Anne's wars, both by sea and land. By sea *anno* 1694, against Kilmore Castle, near Londonderry; *anno* 1694 at the bombardment of Diepe, Havre de Grace, and at the expedition to Vigo. In Ireland at the battles of the Boyne, Agrim, Limerick, Galway and Drogheda. At most of the sieges in Flanders, and at the battles of Landen, Hochstet, Ramilies, Oudenarde, &c." 1716. In this year, when a spasmodic fit of retrenchment was being enacted, the Board of Ordnance suggested to the Duke of Marlborough that the salaries attaching to some venerable offices might be estreated and applied towards the establishment of a *permanent* Artillery Train—among these being that of the *Master-Gunner of England*—on the ground that (as in the case of the aged Captain Richard Leake) "when there hath been any extraordinary service required, this office (Board of Ordnance) hath been obliged to inlist other persons, and to make demand in Parliament for payment of the same." It was then "humbly proposed that as vacancys shall happen in the said establishments the salarys of them be applied to the forming of one or more companies of gunners. . . ." On this occasion this premier office of artillery was saved from the woodman's axe, though in the mutilated form of being designated *Master-Gunner of Whitehall and St. James's Park* (London), with reduced allowances of a Master-Gunner, *i.e.* 3s. per diem. and official residence in St. James's Park; and the three "Mates" or Deputies were retired, but not to be replaced at death. The Artillery Train remained permanent. In 1721 we find the calm narration of the fact that "Colonel James Pendlebury is paid his allowance as *Master-Gunner of England.*"
Geo. II. 1727-1760			1725–1728. John, Duke of Argyle and Greenwich, appointed Master-General of the Ordnance.

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Geo. II. 1727–1760 *(Contd.)*			1740. John, Duke of Montague, appointed Master-General of the Ordnance. 1742. John, Duke of Argyle, re-appointed Master-General of the Ordnance in February; and on resigning, in March, the Duke of Montague was re-appointed in succession. 1749. Duke of Marlborough appointed Master-General of the Ordnance. 1758. Col. Pendlebury, the last *Master-Gunner of England*, would appear to have died in this year.
		1759 *Captain* Joseph Brome.	In the "London Gazette" of 5th January, 1759, Captain Joseph Brome was appointed *Master-Gunner of Whitehall and St. James's Park*, London. Capt. Brome was at this date A.-D.-C. to the Marquis of Granby, after having been A.-D.-C. to Lord Geo. Sackville, Commander-in-Chief. The career of Captain Brome is probably the most extraordinary in the annals of the British army; and at this moment the *Memoirs of the Brome Family* are approaching completion. His mother, Mary Hicks—of an ancient yeoman family (her father being lord of the manor of Charfield, Gloucestershire)—had married, Joseph Walton, of Southwark, and their son Joseph was born in 1711 or 1712. She subsequently married, in Minorca, Corpl. Charles Brome of the Artillery (afterwards commissioned in R.A., and rendered distinguished services). The boy, Joseph Walton, was enlisted, in Minorca, as Drummer Joseph Brome, about 1720 (then 8 years of age), in the company of which his mother's husband was then Corporal Charles Brome. This drummer boy eventually became lord of the manor of Charfield, on succeeding to the maternal estates, but remained in the Artillery and reared a family (some of the sons taking the name of Walton, others that of Brome), who contracted alliances into families of high distinction. He died April 30, 1796, aged 84, a Lieut.-General, Colonel Commandant R.A., Commandant of Woolwich Garrison, Master-Gunner of St. James's Park, and lies buried

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Geo. III. 1760–1820	1759	*Capt.* Joseph Brome. *(Contd.)*	in St. Nicholas Church, Plumstead (his tombstone being immediately within the entrance to the church). After 1737, Captain Brome resumed the name of Walton, for civil purposes; but retained that of Brome as a soldier. 1759. *Viscount* Ligonier, Master-General. 1763. *Marquis* Granby, „ 1796. Major-Genl. Joseph Walton, eldest son of the above-mentioned Lieut.-General Joseph Brome was born at the Gun House, St. James's Park. From Gentleman Cadet in 1753, he became Major-General in 1795; and succeeded his father in 1796 as *Master-Gunner of St. James's Park;* promoted Lieut.-General in 1802; and died, at Woolwich, 24th March, 1808. His grave, in St. Nicholas churchyard, Plumstead, adjoins the church in which his father's remains are interred. General Walton's career will be outlined in the *Memoirs of the Brome Family* (now in course of preparation).

N.B.—Here end the original sources to which I have had access; but Major James Ritchie, R.A., has kindly come to the rescue and unearthed the following Successions from records at the War Office.

Geo. IV. 1820–1830	1808	*Lt.-General* Sir John Macleod, G.C.H.	Appointed *Master-Gunner of St. James's Park*, vice Walton, 1808. Died at Woolwich, 27th January, 1833.
Wm. IV. 1830–1837	1833	*M.-Genl.* ℣ Sir Alex. Dickson, G.C.B, K.C.H.	Appointed *Master-Gunner of St. James's Park* 28th January, 1833. Died in London, 22nd April, 1840.
Queen Victoria 1837	1840	*M.-Genl.* ℣ Sir Robt. Gardiner, G.C.B, K.C.H.	Appointed *Master-Gunner of St. James's Park*, 1st May, 1840. Died at Esher, 26th June, 1864.
	1864	*M.-Genl.* Sir Hew D. Ross, G.C.B.	Appointed *Master-Gunner of St. James's Park* 1st July, 1864. Died at Knightsbridge, 10th December, 1868.

SUCCESSION LIST OF THE MASTER-GUNNERS OF ENGLAND.

Reign.	Date of Appt.	Name.	War Services, &c.
Queen Victoria. *(Contd.)*	1868	*General* W. Wylde, C.B.	Appointed *Master-Gunner of St. James's Park* 11th December, 1868. Died in London, 14th April, 1877.
	1877	*General* ℣ Sir John Bloomfield, K.C.B.	Appointed *Master-Gunner of St. James's Park* 15th April, 1877. Died in London, 1st August, 1880.
	1880	*General* Poole V. England.	Appointed *Master-Gunner of St. James's Park*, 2nd August, 1880. Died at Dover, 6th November, 1884.
	1884	*General* Sir John St. George, K.C.B.	Appointed *Master-Gunner of St. James's Park* 7th November, 1884. Died in London, 17th March, 1891.
	1891	*General* Sir Collingwood Dickson, ℣.C., G.C.B.	Son of General Sir Alexander Dickson, former *Master-Gunner of St. James's Park*, appointed *Master-Gunner of St. James's Park* 18th March, 1891, and is the present Incumbent.

The war services of the successors to Lieut.-General Walton are recorded in detail in the Army Lists.

In 1881 the Master-Gunners were graded into 1st class, pay at 6s.; 2nd class, pay at 5s. 8d.; 3rd class, pay at 4s. 6d.; and *Warrants* were conferred upon the 1st and 2nd classes; but, perhaps by oversight, the *Premier Master-Gunner of England* was relegated to the 3rd class, with lowest rate of pay, and not given a "Warrant," so that at date of succession the *Master-Gunner of St. James's Park*, London, is junior to all the 1st, 2nd, and 3rd Class Master-Gunners!

The "Master-Gunner of England" was, however, not published until 1884 (*Proceedings, Royal Artillery Institution, Vol. XIV.*); the office had been dismissed in the Histories of the Royal Artillery with the scantiest notice, as little beyond tradition was known before the publication of the original Royal Warrant of Queen Elizabeth (in the R.A.I. "Proceedings" quoted) of the dignity and precedence of the Premier Master-Gunner of England: but surely it is not too late to restore the dignity of Warrant grade, of 1st class, to this illustrious survivor of the Artillery ages?

QUICK-FIRING GUNS IN HARBOUR DEFENCE.

BY

LIEUTENANT A. S. BUCKLE, R.A.

Introduction.

An attempt is made in this paper to show how important a part quick-firing guns (and especially the newer and heavier patterns) seem likely to take in the defence of coast fortresses; with a few remarks on the general method of employing these guns, should they be supplied for Harbour Defence purposes in the large proportion that seems necessary.

It may appear in the following pages that the words "likely," "probable," "seem," &c., are very often used; so often that the whole paper appears to be a mass of theory. But so faint is the light hitherto thrown by practical experience, under present conditions, on the question of ships *v.* forts, that no absolutely certain answer can be given as regards any of its aspects. What little is known from actual experience, however, encourages the Coast Artilleryman to hope that the ideas he at present holds (on which this paper is founded) may be borne out when put to the practical test of real fighting.

Description of *Matériel.*

A short description of the guns of this nature that have at present been made, and their capabilities, may be of use before proceeding to discuss their advantages.

Of the lighter patterns we have the 6-pr. and 3-pr. Hotchkiss and Nordenfelt guns: of these a good many have already been issued to coast fortresses—the 6-prs. as auxiliary armament, the 3-prs. for the defence of mine-fields chiefly. All quick-firing guns fire common shell of two kinds; steel, pointed, practically armour-piercing; and cast-iron. They also have case shot. The 4·7-inch gun fires shrapnel in addition: while the 6-inch ammunition has not yet been decided, but will probably follow the same lines. The 6-prs. have a muzzle velocity of about 1830 f.s., with black powder, and will pierce two inches of steel at 1000 yards, while the 3-prs. at the same range, muzzle velocity 1870 f.s., will pierce 1·8 inches. They range *effectively* up to about 1700 yards, and 10 aimed rounds per minute can readily be fired with these smaller natures.

The 4·7-inch quick-firing gun fires a 45 lb. projectile with muzzle velocity 1786 (black powder). With this velocity it will penetrate 5·4 inches of steel at 1000 yards, but the muzzle velocity when using

cordite is 2150 f.s., so that we may fully expect to overcome a six-inch plate 1000 yards away, with this gun. With it 15 well-aimed rounds have been fired in 2 min. 52 sec., the laying being delayed by a head-wind which drifted the smoke straight back over the gun: under good conditions five aimed rounds have been fired in $30\frac{3}{4}$ seconds. Its effective range is from about 2400 yards up to 3000.

The 6-inch quick-firing gun has a 100 lb. projectile, muzzle velocity 1920 f.s. (with cordite 2250), giving a penetration of 14·3 inches of wrought-iron at the muzzle; 10 aimed rounds have been fired from this gun in two minutes.[1]

Smokeless Powder.

It may be considered certain that, as soon as possible, some smokeless propelling agent will be introduced for all quick-firing ordnance; cordite for them is still in the experimental stage. All difficulties in laying caused by smoke will then be removed; the above results in rapidity of firing were all obtained with smoke-producing powder.

Ships' Fire at Present Superior in Volume.

Almost all modern ships of war carry a number of these guns as auxiliaries to their main armament, and the secondary guns of some ships are to be or have been replaced by the heavy quick-firing guns. If, then, harbour defences are not provided with similar weapons, they will be placed at a disadvantage in fighting ships, for the ships will have the superiority as regards rapidity and volume of fire. On the other hand, shore guns of any description have many advantages over those on ship-board; they fire from a steady platform, their supply of ammunition may be practically unlimited, and when properly placed they offer a very small target: so that, if the shore defences be provided with a quick-firing armament to correspond with that already on the ships, it is very evident on which side the advantage will lie.

Reasons for Q.F. in S.S.

Again, let us consider the purposes for which quick-firing guns were introduced into the Naval Service. These were:—

(i.) To disable torpedo boats by piercing the boiler, &c. A quick-firing gun with flat trajectory, giving a large danger zone, best fulfils this object, as the target is small and moves quickly.

(ii.) To render the service of guns in unprotected portions of ships an impossibility. The unarmoured portions of any ship are penetrable by the lightest guns, so that a piece capable of sending a dozen or so of destructive projectiles into them in the space of a minute was just what was wanted: and guns which can in the same time burst half-a-dozen shell of 45 or 100 lbs. weight amongst the guns' crews, at a much greater range, are likely to be even more effective.

It is clear that if the seaman gunner strives to attain these objects when fighting a hostile ship, or endeavouring to keep off the enemy's torpedo boats, so also will the Coast Artilleryman when he has to engage an attacking or passing enemy's ship, or when defending a mine-field or landing-place; and if the former finds quick-firing guns

[1] Its powers are equal to those of the service 6-inch gun.

to answer best for these purposes, the latter, therefore, requires to be supplied with the same weapons.

Common Shell.

It must now be well known to every Coast Artilleryman that for his purposes *common shell* is the *most useful* projectile, armour-piercing shot ranking next in efficiency. The Coast Artillery question of "choice of projectile" only becomes complicated when dealing with armoured ships. Even in this case authorities such as Captain Orde Browne give it as a maxim, that far more destruction is wrought upon an armoured ship by sending a *live shell* into the unarmoured parts, than by trying (usually with small prospect of success) to force a mass of *dead metal,* as an armour-piercing projectile is, through the armour into the vitals. Modern war-ships without exception present a very large unprotected area, and their secondary armament has either very slight protection, or is surrounded merely by a thin skin of iron or steel which would just serve to burst common shell effectively, and increase the havoc with its own fragments. Thus it seems that a well-directed fire of common shell at an armoured vessel's unprotected parts must result in the almost immediate silencing of all guns not behind armour, and in such considerable destructive effect on the ship herself, and her crew, that for her own safety she must speedily withdraw from the contest. The greater the number of these projectiles that can be poured in in a given time, the sooner will the above results be obtained, and the greater will be the demoralizing effect on the crew; so here again quick-firing guns appear to be the most suitable ordnance to employ.

And the above argument in favour of the use of quick-firing guns in Harbour Defence of course applies all the more strongly in the case of unarmoured vessels. Indeed, at a station far removed from an enemy's base, which would therefore be liable to attack by his cruisers only, it is conceivable that the heaviest guns required would be a few 6-inch quick-firers.

Armour-Piercing Projectiles.

Against the older broadside ships, which are armoured all over with some five or six inches of iron, it would seem that armour-piercing projectiles would have to be used in preference to common shell. Naval men declare that a few Palliser shot making clean holes through a ship are not of much account; but if with the aid of the 6-inch and 4·7-inch quick-firing guns we could manage to convert the *few* into *many* they might possibly alter their opinion. Further, provided penetration can be secured, an armour-piercing projectile, passing through a plate whose thickness approaches the maximum power of the gun, will break up almost as destructively as a common shell.

Whilst we are considering the value of the employment of armour-piercing projectiles it may not be amiss to recall to mind that a 6-pr. quick-firing gun, at a short range, has rendered a new-type gun unserviceable by striking it on the chase; and the Inchkeith experiments in 1884 have shown of what excellent target practice this piece is capable: so that we may fairly expect good effects by firing quick-firing guns at the exposed armament of modern barbette ships.

Probable Forms of Attack.

Captain H. J. May, R.N., in the course of two very interesting lectures on "The Naval Attack of a Coast Fortress," delivered lately

at Shoeburyness, said that if an enemy on the sea could do what he wanted with small, fast craft, he would endeavour to push them past the coast works in preference to risking his valuable sea-going ships. Also that all removal of obstructions in a barred channel would be attempted by the same class of vessel. Against these quick-firing guns would be of the greatest utility. He was of opinion that if the enemy did determine to take the risk of running his fleet through a defended channel, having cleared the way, his fastest ships, probably unarmoured cruisers, would dash in first. A concentrated fire from heavy quick-firing guns would give a very good chance of disabling these, and so delaying under fire the armoured ships following in their wake for a time sufficient to put them also out of action by riddling their unarmoured portions. He further said that raids by cruisers would be the form of attack most likely to be met with; and this class of vessel is the very one with which quick-firing ordnance are best able to cope, and for engaging which they are chiefly superior to the ordinary weapons of destruction.

To meet all the naval operations mentioned in the last paragraph, the importance of the following words, quoted from the manual of Garrison Artillery, Vol. I., 1887, is most apparent:—"Against ships in motion, or in the defence of a channel attempted to be forced by steam-ships, it (the rate of fire) *cannot be too rapid*, provided the gun is carefully laid." No other class of ordnance can fulfil this commandment so well as the quick-firing guns.

It is probable that the lighter quick-firing guns may be used, on cone mountings in railway trucks, for the defence of land fronts, but this enters more into the domain of Siege Artillery. They would probably have to be used independently, though for such a purpose as repelling an assault they could be massed in a train, to be moved to the various points of attack as required.

Defence of Mine-fields.

The utility of the lighter natures, particularly the 3-prs. on field carriages, for the defence of mine-fields has already been recognised by their adoption in the Land Service; so that nothing need be said here on that point, further than that it would be advisable to prepare covered positions for their use—two or three positions for the same guns under various circumstances, if necessary.

Machine guns (except the 1-inch Nordenfelt, should that be introduced for Land Service) would all be in the hands of the infantry, their *rôle* being to intensify or supplement infantry fire.

Summary.

To summarise generally the above considerations we see that quick-firing ordnance, more especially the 6-inch and 4·7-inch guns, if employed in Harbour Defence, will afford most valuable aid as auxiliaries to the main armament of the defence; will in a good many cases be equivalent to, or even do better work than such main armament; and will perform certain special duties with far more effect than can be hoped for by the use of any other weapons. Under these circumstances we may consider it certain that before very long (*i.e.*, when the supply of these guns to the Navy has been completed), those of the Royal Artillery whose duty it is to man our harbour defences will have a considerable number of guns of this description

in their charge. It will be for them, in concert with the Engineers, to decide how to dispose them to the best advantage; to evolve for them schemes of organisation and tactical employment; and to so train themselves in the service of the new guns that they may be ready when the time comes to use their great powers to the full. For from their nature these guns will require a special scheme for their working, differing somewhat from those that may already have been drawn up for the present armament, as I hope to show later on: though being a scheme for *auxiliary* armament only, in most cases, it should not, of course, in any way interfere with that already in existence for the general tactical working of the fortress.

Disposition.

Present ideas on the position of guns on a sea-front are embodied in the words "dispersion" and "concealment." Groups of well-dispersed and well-concealed emplacements—the guns mounted on disappearing mountings for low sites, and *en barbette* with bullet-proof breech shields when at a moderate height—with an infantry redoubt here and there to keep off landing-parties; such emplacements are to take the place of conspicuous works, crowded with guns cramped behind armour or exposing their detachments to machine-gun fire. Quick-firing guns cannot, of course, be placed on disappearing mountings,[1] but lend themselves perfectly to the barbette form. One of these guns thus mounted can practically only be put out of action by a direct hit either on the gun itself or on the crest of the front of the emplacement: and, if properly concealed, would even on a low site be so difficult to distinguish, and present such a small target when seen that it would seem, judging from the few direct hits obtained by the fleet at Alexandria, almost impossible for a ship's gun to do it any damage. The difficulty of ranging the machine guns of the ships at Alexandria, and the results of the Inchkeith experiments would make it appear that the gun detachment, protected by a bullet-proof shield, have not much to fear from machine-gun and shrapnel bullets.

Where, as in most coast fortresses, forts already exist, it is important for many reasons, such as noise, smoke, &c., that quick-firing guns be kept outside these works at some little distance. In some cases, however, as in the Spit Forts, it is impossible to do this; but these are exceptional. The present organisation for quick-firing guns lays down that they shall be under the control of the Fort Commander through a Sub-Commander. As it is in the highest degree essential that every gun of the fortress shall, for purposes of concentration and direction of fire, &c., be under the control of some officer exercising, under the Section C.R.A., the duties of Fort Commander, it would seem inadvisable to place the new guns *too* far away from the existing work; unless they be made to form the armament of a new Fort Commander's command. This would hardly be done if they are to be considered merely as auxiliary armament.

"Dispersed" Groups.

Combining the considerations of necessity for dispersion of guns and necessity for control of their fire, it appears that these guns will most probably be found disposed in groups of not more than three of

[1] The "balance pillar" mounting can hardly be called disappearing, for the gun is exposed the whole time it is in action.

the heavy or four of the lighter natures, the guns in each group being placed some 30 or 40 yards apart, or if traverses are placed between the guns about 20 yards apart. Local circumstances, of course, will determine many points of detail. The work of loading the 6-inch and 4·7-inch quick-firing guns in rapid firing is very heavy, so that the loading numbers require to be frequently relieved; cover for the reliefs must therefore be provided close at hand. It would also be advisable to provide communication, screened from fire and observation, between the guns, and from them to observing stations on the flanks. For it may be taken for granted that the man who lays a quick-firing gun will, in rapid firing, be too much occupied with the laying of the next round to be able to observe where his last round went: and it is not necessary that he should, so long as the officer in charge of the group of quick-firing guns is able to observe the fire of his group. As his duties differ somewhat from those of the present "Group Officer," I would term this officer a "Group Commander." As one man lays both for direction and elevation, and generally superintends the working of the gun, thus combining the duties of gun-layer and gun-captain, he may be conveniently designated by the old term of "No. 1."

Method of Working Proposed for 6-prs. in Forts.

I am not aware of the method that has been devised of working for the exceptional cases, as above, where 6-pr. quick-firing guns have to be mounted alternately with the heavy guns *in* the fort. But it appears hardly possible to control the fire of these pieces in groups, so that these seem to be the only cases where fire-control must be left to the Nos. 1. I imagine each of these might do best by working as follows:—Keeping under cover till the ranges passed down show that the objective is nearly within his effective fire, he would then go to the nearest heavy gun on his right hand, say, and, by looking along the gun when laid, find out the group objective; by then firing at this objective as fast as he can, only stopping to alter his tangent-sight according to the ranges passed down to the heavy guns; having previously been informed what correction he must make for the "error of the day" of the quick-firing guns in the heavy gun group, which would then all be firing at the same objective under much the same conditions of elevation, &c.; and an observer stationed at a central port, or at the position-finder, or other observing station, might perhaps to a certain extent correct their fire.

Methods of Fighting "Dispersed" Group against moving Objective.

Returning to the "dispersed" groups described above, away from the fort, there seem to be two methods of fighting them when engaging a moving ship—the only sort of objective likely to be presented to them. In both cases, except at close quarters, the Fort Commander would point out the objective to the "Group Commander," with whom he must be in communication; also the "Group Commander" must have some means, whether by electric or visual dials, of communicating angles of training, when he wishes to give his Nos. 1 their objective; and of passing to them the various elevations and amounts of deflection at which he may wish them to set their tangent-sights. In each case, moreover, the "Group Commander" will require some means of giving special signals to his Nos. 1, such as when to commence or

cease rapid firing, &c. Consequently in each case one man per gun will be required as a "dial number," to watch these means of communication, and call out changes of range, signalled orders, &c., to his No. 1.

Salvo Firing.

If the firing were to be by salvoes the rapidity of fire, the peculiar quality of quick-firing guns, would to some extent be lost, and the difficulty of getting the group to work together sufficiently well to effect this species of fire properly, under the circumstances of their distance apart and the special nature of the guns, would be considerable; on the other hand, the difficulty of smoke, which at present unfortunately still exists, would be minimised by firing salvoes, and the fire would be under the best possible control. But it seems hardly possible that quick-firing guns will in practice be fired by salvoes, from their very nature; probably, too, by the time we have them in large numbers in the Land Service they will be fired with smokeless ammunition; and there seems no reason, if the "Group Commander" is able to start or stop his fire at will, why it should not be under sufficient control when each gun fires as rapidly as it individually can.

The methods of working that suggest themselves are these:—

First Method (with Range-Finder.)

(*a*) The "Group Commander," his objective having been indicated to him, points it out to his Nos. 1 by transmitting to them its bearing. He then takes the range of the objective with a depression range-finder at his observing station—on the windward flank of the group—and, making his corrections for strength of powder, speed and direction of vessel (as if he were a Fort Commander), *and also for displacement* (by using a difference table in conjunction with the graduated horizontal plate of the range-finder), he sends down to the group the corrected range and signals "Commence slow fire:" each gun then, beginning from the leeward flank, fires a shot (by signal) at the rate of about one per minute per gun. Before the first minute is up the "Group Commander" should have been able to send down his additional corrections on the first two rounds, and he then gives the signal "Rapid fire." On this each gun continues its fire as rapidly as possible, the Nos. 1 receiving from their dial numbers each change of elevation necessary, as given by the range-finder and transmitted corrected by the dials, and altering their tangent-sights accordingly. The "Group Commander" should, by the proper use of his dials, control and correct the fire; but if it becomes wild or unsteady he may have to bring it to a temporary stop, to pull the group together as it were. This method secures the advantage of continuity of fire, but requires a range-finder, and seems liable to get temporarily out of hand.

Second Method (no Range-Finder necessary.)

(*b*) As before the "Group Commander" points out to his guns the objective indicated to him. In this method no range-finder need be used, but the "Group Commander" estimates

the range to begin with, in doing which he would receive considerable assistance if the Fort Commander were to send down to him the range as given by his own range- or position-finder, at the same time that he points out the objective.

The "Group Commander" would pursue a system much the same as that adopted in ranging a Field Battery at a moving object. Suppose, for example, the ship to be approaching the battery. All the guns take up the range given on the dial, which would be some 100 or 50 yards short of the estimated range of the ship. The leeward gun would then be signalled to fire a ranging shot. If this be observed to fall somewhat short, the same gun will again fire after a short interval—if the shot were observed very short, the elevation of the group would first be increased. When the "Group Commander" observes a ranging shot to fall close to the ship he signals "Rapid fire," whereupon all the guns pour in their fire at the utmost possible speed; until the "Group Commander" perceives several shot to fall over or burst high on the upper works of the ship, when he orders "Cease fire," reduces the elevation shown on the dial, and orders "Slow fire" again from the ranging gun, and "Rapid fire" when the ship comes to the new range. This he would continue, taking care that the differences of elevation are not so great as to cause serious delay in the fire. For a ship moving away from the group he would fire ranging shots over, and range again as soon as he saw his "rapid fire" shells striking the water on the near side of the ship.

Rate at which Ranges change.

Against this it may be urged that a modern fast ship, such as these guns would be likely to engage, may be moving at the rate of some 22 miles an hour, or nearly 650 yards in a minute. But this does not mean that her *range is altering* at that rate—that would only occur when she is running straight in on the battery, which is not likely if she moves at this tremendous pace. This excessive speed could only be attained when the hostile ship is trying to run past the shore defences, and under these conditions the rate at which the range alters would not be nearly so great; the change in the cruiser's range would probably not exceed 300 yards per minute for any course that she is likely to take. And if we consider only the freeboard of the vessel and shots fired at one elevation, we see that she is likely to be hit by them whilst the range changes by nearly 100 yards. For the mean freeboard, in graduating index plates for guns in elevated batteries, is taken as 14 feet. Taking as an example a 4·7-inch gun firing at a ship at a range of 2000 yards, from a site 100 feet above sea level. Here the tangent of the angle of sight is $\frac{1}{6}\frac{0}{0}$, which gives the angle as 1° roughly, and the angle of descent at 2000 yards given in the range table is 2° 43′, making the whole angle of descent nearly 4°. Taking it as 4° we get the horizontal distance corresponding to this, with a height of 14 feet, as nearly 70 yards. To this we may add at least a

considerable fraction of the length of deck in the line of fire, for the decks of modern ships present many objects that will keep a shot from glancing. Besides the gun is laid by the sights for elevation as well as direction, so that less elevation is really given to it as the ship comes closer. Thus we may fairly say that the ship is likely to be hit by rounds fired at the same tangent-scale elevation whilst she changes her range by 150 yards, or, taking the extreme case of a speed of 22 miles an hour, during at least half-a-minute. Thus even with the 6-inch gun we might expect to get off three rounds by rapid fire at each elevation at which ranging rounds are fired, or six with the 6-pr. at the least.

From this it would seem that with a rapidly moving target, using 6-inch or 4·7-inch guns, the first system (*a*) proposed would be most suitable, and with these guns a range-finder would probably be provided; while with the 6-prs. no range-finder would be required under any conditions, so use (*b*).

In the attack of torpedo-boats, whose movement is so extremely rapid while presenting such a small target, it would be advisable to fire at the *nearest* boat until disabled or out of range or training. From the shortness of a torpedo-boat, added to its speed, it follows that deflection *must* be given in the direction of its movement, or the shots will fall behind it.

Proposed Method of Correcting for the 'Dispersion' of the guns.

As the guns in a "dispersed" group, say of three guns, as above described, might be as much as 40 yards apart, it follows that, in shooting at a target moving on a flank, such as a ship advancing up the line of coast towards the group, the gun on the flank furthest away from the target would be nearly 80 yards further away from the objective than the gun on the nearer flank, and the centre one 40 yards. It must be decided whether to take this into account and endeavour to reduce to a minimum the disadvantages of laying guns, whose ranges really differ as much as is shown above, as if they were all at the same distance from the objective; or whether to disregard it altogether. The disadvantages must be considerable, and I would propose a way of surmounting them, though this introduces fresh complications in the laying, and causes parallelism of fire. This latter would not in this case have the disadvantages attending it when using position-finders with heavy guns, as it would not be a question of knocking armour to pieces by blows planted close together, but of attacking unarmoured spaces with man-killing projectiles; and there the parallelism would only mean distribution of the fire, rather an advantage than otherwise, if only the increased difficulties of the laying can be got over. We are taught that the guns must be laid on some prominent and unmistakeable part of the ship, such as the bow, centre funnel, stern, &c., to give the layers some well-marked aiming point, and to ensure uniformity; the Fort Commander directing his fire on particular portions, if necessary, by giving deflection. Still keeping to this principle I would propose, in the group of quick-firing guns described above, that the Nos. 1 of the guns should be instructed to lay each on a different prominent point of the ship, on the order "Distribute the fire." The No. 1 of the gun on the farther flank would

then lay on the nearest well-marked aiming-point on the ship, the the No. 1 of the centre gun on a point somewhat further away, and so on. These points would be selected, in each class of ship, according as they will best correct the difference in the guns' ranges, at the same time giving the best results on the ship by bringing under fire the portions it is most desirable to attack. If possible, the "Group Commander," having so studied the "identifying officer's" diagrams of the enemy's ships as to have made himself acquainted with the most advantageous aiming-points, selected as above, or being himself supplied with such diagrams, would indicate these points severally to his Nos. 1 as soon as he had been given his objective.

Distributed fire in Ranging.

As the position of the guns when ranging (if all the guns be used for that purpose), and when pouring in their rapid fire is the same, the fire would in both cases be thus distributed; unless it be desired to concentrate the fire as the vessel comes more to the front of the group. It does not seem that the observation of the distributed fire in this ranging would be any more difficult than in the case of a Field Battery ranging on a line of troops parallel to its front.

Use of this Method.

This complicated method would, however, only be used where it was considered necessary to try to correct for the distance of the guns apart, and this would only be in extreme cases.

Reliefs and General Discipline.

With regard to the reliefs of working numbers, and general discipline, a Sub-Commander would be detailed, whose post would be at the guns, moving from one to another by the covered communication. If no officer could be spared there seems no way except to delegate these duties to the Nos. 1 of guns: unless a N.-C.O. could be trusted to act as a Sub-Commander.

Night work.

For operations at night, when authorities state that no *large* vessels need be expected as antagonists, the importance of quick-firing guns will be even greater, and consequently their efficient working then becomes all the more a necessity. As with the present armament, the same schemes would be available as are used in daylight, but of course a special point must be made of practising them in darkness, as all difficulties then increase in magnitude tenfold, and can only be avoided by frequent rehearsals.

Training of the *personnel*.—"Group Commander."

The efficient working of quick-firing guns in Harbour Defence must necessarily entail a very high standard of training in the *personnel*. The "Group Commander's" duties much resemble those of a Fort Commander. He must be thoroughly practised in observation of fire, and in deducing from it his corrections; he must be well-informed with regard to all details of attacking ships, and must be able to exercise complete control over his guns without delaying or hustling their fire.

No. 1.

The No. 1 of a quick-firing guns would have to be most carefully selected, as a good and quick layer, and as likely to possess the greatest coolness under the most disturbing conditions. He should, after special instruction, be conversant with the mechanism of his gun and its mounting, and be able quickly to replace a damaged part, if that can be done under the circumstances. He must be thoroughly practised in laying his own gun quickly at a moving object, altering

his tangent-scale elevation at once when a change in it is passed to him by his dial number.

Absolute necessity for liberal scale of Ammunition for Annual Practice.

If it is important for any gunners to fire as many practice rounds as possible from their guns, it is doubly so for the No. 1 and detachment of a quick-firing gun (as also for their "Group Commander"), whose efficiency depends on their being completely accustomed to the working of their weapon in *rapid* fire at practice; the more rounds they are allowed to fire, under such control that the shots are not wasted, the more likely they are to become efficient. The most important point, however, to be instilled into the No. 1 is that he must *never* fire his gun until he is satisfied that it is correctly laid—a gain in rapidity at the cost of accuracy would be worse than useless, for without accuracy the much greater rapidity of fire gained with these guns would only mean a much greater waste of ammunition.

It would also be important that each No. 1 should be told off to a particular gun, and work only with it, so that he might acquire sufficient manual dexterity in the laying.

Qualification as Paid Specialist.

If qualified as a layer he should be entitled to some extra pay as a specialist without regard to the number of these already in the company; but such qualification would only be attained by passing a much severer test, both as regards time and accuracy, than that at present laid down with ordinary guns. He would, however, be tested at his own gun.

Spare No. 1.

There should also be selected from the detachment an intelligent man to act as the No. 1's "understudy," trained in the laying; so that should anything happen to the No. 1 this man could take his place. The No. 1 and his understudy should be the only numbers allowed to lay and fire the gun, and should have permanent charge of it.

Loading Numbers.

Strong active men would be selected as loading numbers, and they must have enough practice to attain the greatest dexterity and smartness. The changing of the loading reliefs must also be practised frequently, that no time may be lost in so doing.

Conclusion.

It will have been observed in the foregoing remarks that no attempt is made to describe "manufacturing" details, if it may be so expressed, of any scheme; all such would suggest themselves, and would, of course, be worked out on the spot. Only the probable dispositions and general methods of working have been attempted. The subject is comparatively a new one, on which opinions have not yet been expressed in writing; some of this paper may be contrary to the ideas of those who have given thought to the matter, but, as an attempt to bring the subject forward, it may at least be useful in leading to a further elucidation, by others, of this important and complicated question. It is hoped that these suggestions do not look too far ahead, and may be of some use to the Service.

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APR 1 1893

NOTES OF LECTURES

ON

ARTILLERY IN COAST DEFENCE.

BY

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(Instructor of Gunnery).

The following notes of a course of lectures are published in the hope that they may be found useful. The lectures were based on the instructions contained in the "Provisional Manual of Tactical Working of Coast Artillery," and other official publications. In addition great use has been made, in that part of them relating to fire tactics, of "Fortification," by Major Clarke, R.E., "Brassey's Naval Annual," various papers published in R.A.I. "Proceedings," &c.

PART I.

In these lectures it is proposed to consider the arrangements which have to be made and the methods which are adopted to secure the efficiency of the artillery of a coast fortress to repel attacks by sea.

The very important branches of the general subject of coast defence, which include submarine mining and the employment of coast defence vessels to aid the artillery defence are not treated of, as not falling within our province as gunners. In considering how best to employ the guns of a coast fortress the following questions present themselves :—

(*a.*) What preliminary arrangements must be made in order that an effective fire may be opened at the right moment, and maintained until its object is accomplished ?

(*b.*) By which fort or guns should each of the enemy's ships be attacked ? at what part of the ship should the fire be directed ? and with what projectiles ?

(*c.*) How shall we ascertain the correct elevation and direction in order that the projectiles may hit the right spot ? in other words, how shall we control the trajectory ? And, lastly,

(*d.*) How shall we ensure that the results of successive rounds shall be consistent ? in other words, that there shall be no irregularity in the shooting due to preventible causes ?

The answers to question (*a*) we consider under "Organisation ;" the

questions (*b*) are treated of under the heading "Fire Tactics;" to (*c*) under "Fire Control;" and to (*d*) under "Fire Discipline."

Before proceeding to consider "Organisation" a few definitions are, perhaps, necessary. A "Coast Fortress" is defined as an area of land and sea, provided at certain points with an artillery armament, partly "fixed," partly "movable," and its area is the extent of land and water which can be covered by the fire of its guns; the water area is the part with which we are concerned.

The "fixed armament" consists of such guns as are mounted on garrison mountings in permanent positions of whatever nature. It is divided into two classes, the "primary" and the "secondary" armament.

The "primary armament" consists of R.M.L. guns of seven inches and upwards, and of B.L. guns of six inches and upwards (and possibly the 6-inch quick-firing gun if introduced for land service). These guns fire armour-piercing projectiles, and would be used to attack the armoured portion of vessels as well as the unprotected parts. The "secondary armament" consists of the lighter natures of R.M.L. and B.L. guns, of R.B.L. guns, and quick-firing guns on garrison mountings, whose function would be to keep up a rapid shell fire on the unarmoured portions or the ports of an enemy's vessels, and to repel boat attacks, or attempts to land troops, and in some cases to assist in the protection of mine-fields.

The "movable armament" consists of siege guns and howitzers, field, machine and quick-firing guns on travelling carriages. They would be employed sometimes in prepared emplacements inside the forts to intensify the shell fire of the secondary armament and generally to assist it in the various tasks mentioned above; more usually they would be placed outside the fort in selected postions. Howitzers would be placed in concealed batteries where possible for the purpose of employing high-angle fire at ships' decks. This part of the armament would take part largely in the defence of land fronts.

A perfect artillery organisation is only attained when the forts can be manned and a rapid and effective fire opened at the best objectives in the shortest possible time; and such a fire kept up until the desired object has been accomplished.

In order to attain this end it is in the first place necessary that, as far as possible, every man in the garrison should know his station and duties in action, and that a proper chain of responsibility should be established. In the next place that the best methods for storing ammunition and supplying it rapidly to the guns, and of replacing without delay casualties to men or stores should be devised. Further, that the best means available are made use of for communicating orders, for indicating objectives, for finding and communicating ranges and deflections, and for observing the results of fire, and that they are thoroughly understood by all concerned. Lastly, that the possible modes of attack by an enemy's fleet should have been thought out beforehand and schemes of defence drawn out; so that no waste of time and ammunition through firing at improper objectives may take place.

In the first place then the fortress must be split up into tactical

units, each under a commander who will have, in action, a definite task to perform, which will usually be the defence of a certain portion of the water area; for instance, an entrance to the harbour or a bay from which an enemy might endeavour to bombard a dockyard, or to effect a landing, &c. Next, an economical but efficient scheme for manning the various guns and works of each unit must be drawn up.

The largest tactical unit is termed a "Section," and its commander a "Section Commander." This officer may be of any rank and arm, and if not an artillery officer will have on his staff the "Section C.R.A.," who will command that arm.

A "Section" consists of such forts and batteries as bear on the area which the Section Commander has to defend; the principle on which the fortress is divided being that each Section Commander should only have to control one distinct action at a time.

There would also be mine-fields, coast defence vessels, &c., under his control; these latter to provide the power of counter-attack on the water, the artillery defence being necessarily passive.

The next tactical unit is the "Fort" under a "Fort Commander." It must be understood that the tactical meaning of the term "fort" includes not only closed works, but any battery, or group of batteries or works, which, for purposes of fire control, are placed under one command. Just as a Section Commander should usually only have to control one action at a time, that is to fight an enemy's squadron attempting one definite object; so the Fort Commander, as a rule, would have to fight only one of the enemy's vessels at a time; consequently the guns placed under his command will all approximately be able to be brought to bear on one objective, not necessarily at the same moment, but at any rate consecutively. The Section and Fort Commanders are in an analagous position to the officer in command of a squadron and the Captains of the ships of that squadron, the O.C. of the squadron exercising tactical control over his ships and directing them against the proper objectives, as the Section Commander does with his forts; while the Captains of ships and Fort Commanders fight their ships or forts to the best advantage against the objectives pointed out to them.

The next lower tactical unit is the "Group" under a "Group Officer." A group consists of such a number of guns as from their position can be conveniently supervised and commanded by one officer. The guns of each group must not be too many in number, therefore, or too far apart; each group *must* consist entirely of guns which can be brought to bear on the same objective; and should be of the same nature and calibre; and at the same height, approximately, above sea level.

The group is the ultimate tactical unit, its guns being always fought at the same objective; they must, therefore, all be able to bear on one spot or some will always be out of action, and if of different natures they will often require to be laid at different ranges to hit the same mark, and may require to use different projectiles against any given ship, thus making the fire discipline exceedingly complicated and likely to break down.

Under the Group Officers are the gun captains in charge of the detachment and stores of a single gun, for which they are responsible to the Group Officer. The single gun is the unit of organisation though, as said above, the group is the smallest *tactical* unit.

In some cases a single gun constitutes a group by itself; when the gun captain may be required to perform the duties of Group Officer as well as his own.

Under ordinary circumstances then the chain of responsibility is as follows :—

The Section C.R.A. directs the action of the forts in the section.

The Fort Commander controls the fire of the groups in his fort.

The Group Officer is responsible for the fire discipline of his guns.

But circumstances sometimes render necessary additional links in the chain.

For instance, as has been said above, the Section Commander should only have to conduct one action at a time, but for various reasons it may be thought advisable to put under his administrative command forts which do not bear on the water area with whose defence he is primarily concerned; and which might, therefore, become engaged in a distinct action with a detached squadron of the enemy's fleet.

In order to avoid the loss of control and consequent loss of power which would be involved if the Section Commander had to give his attention to two separate battles, a link is interposed between him and the Fort Commanders for that part of the section which is the least important, the tactical control of that part being placed in the hands of a "Sub-section Commander" who exercises over it in action the same control as a Section Commander, subject only to general directions as to his tactics from the officer commanding the whole section.

An isolated fort might sometimes be constituted a "Sub-section," in which case the Fort Commander would become also Sub-section Commander.

Similarly some faces of a fort or flanking batteries may be so placed that their guns could not be engaging the same vessel as the main fronts. Loss of control and power would result if the Group Officers of these faces or batteries were left to direct their fire on objectives of their own choice, so "Sub-Commanders" are appointed for such parts of a fort, who have the same powers of fire control over the groups placed under them as a Fort Commander, receiving from him general directions as to the objectives they are to attack.

In cases where the most important groups of a fort are fought by position-finder, whilst less important groups are fought by depression range-finder, Sub-Commanders would be appointed for the depression range-finder groups as also for batteries of movable armament placed outside the fort.

Where a sub-command consists of only one group of guns, the Group Officer would be treated as a Sub-Commander.

Certain groups of heavy guns having a wide field of fire and fought by position-finders are sometimes taken out of the Fort Commander's control and kept directly under the orders of the Section C.R.A., who

exercises fire control over them through a staff officer at his fighting station. The *rôle* of these guns is analagous to that of the Corps Artillery of an Army Corps. They would be used to support the action of any fort which, in the opinion of the Section Commander, might require assistance in engaging the objectives allotted to it.

Besides these officers who exercise tactical control or fire control over the various units and whose duties we shall consider under the heads of fire tactics, fire control, and fire discipline, there are others who have special duties to perform, these are Sub-Commanders (for discipline), ammunition officers, and electric light officers, who are all under the orders of the Fort Commanders, with the exception of officers in charge of Section Commander's lights.

The "Sub-Commander for discipline" is the representative of the Fort Commander on the gun floor. His presence is rendered necessary when, as is usually the case with guns of the primary armament, the Fort Commander has his station at some distance from the groups, near the instruments (range or position-finders), by the aid of which he controls their fire.

In such cases a Sub-Commander is appointed to see that the Fort Commander's orders are carried out and to supervise and assist the Group Officers.

His duties must not be confounded with those of a "Sub-Commander with fire control" who actually fights the guns under him, while this officer has nothing to do with the fighting of the guns.

His chief duty will be the general supervision of the discipline of the gun floor; he will have to see to the prompt transmission of orders from the Fort Commander to the Group Officers; he will have to superintend the removal of wounded and to the replacement of casualties among men or stores, for which purpose a portion of the reserve would be placed under his orders; and he would be in direct communication with the Fort Commander.

He would not interfere (unless ordered) with the Group Officers as regards the fighting of the guns, nor with the Ammunition Officer; but should a group for any reason become disorganised and its shooting consequently unreliable, he will cause it to cease firing, reporting the fact to the Fort Commander.

Electric lights are used for two distinct purposes, and are controlled according to the purpose for which used.

Search lights are mainly used for finding out the position of an enemy's vessels, and are controlled by the Section Commander.

Fighting lights are used principally for lighting up the vessels when found, and each Fort Commander would usually have one such light under his control.

The means of generating the light, and of keeping it in action, are entrusted to the R.E., but with each light there will be two men of the R.A. to elevate and traverse it under the direction of an R.A. officer (or N.-C. officer).

The system on which these lights are worked (only provisional at present) is shortly as follows. The Section Commander's search light (assisted sometimes by some of the fighting lights) searches the water

area of the section in successive zones, and when an object is found the Section Commander orders a Fort Commander to direct his light on that object and engage it; as soon as the fighting light is thrown on to it, the search light is taken off and continues to search the rest of the area. When a vessel is about to pass out of the fire area of a fort, the next Fort Commander is ordered to light up and engage it, and so on. Fighting lights have stops or shades so arranged that they cannot accidentally light up friendly works. They are usually placed outside and at some distance from the fort, but are in direct communication by telephone or telegraph with the Fort Commander's station. The Section Commander controls his search light direct through his Electric Light Officer, and the fighting lights, when he requires them for searching, through the Fort Commanders.

Ammunition Officers are in command of the details of men required for the supply of ammunition to the gun floor from the magazines. It is their duty to superintend the whole of the operations on the magazine floor, to see that every man knows his post and his duty, and that the magazine regulations are strictly obeyed; they must keep exact account of the ammunition expended and render a report of it and of the amount remaining in expense stores and magazines at the end of the action, or when required, to the Fort Commander. They must see that no delay occurs in supplying the guns, and must give timely notice to the Fort Commander when the expense stores, &c., are becoming exhausted. All unexpended ammunition should at once be returned to the expense stores on completion of the action. In very large works one or more officers or N.-C. officers would be detailed to help the Ammunition Officer; while in small works a N.-C. officer might perform his duties.

The provision of an economical but efficient manning detail for each fort is the next necessity. This detail is made out on Army Form A 2008, and it is divided under five separate headings.

The first division is the "Fort Commander's staff." This consists of the officers or N.-C. officers required to assist the Fort Commander at his fighting station with his observing instruments and charts, of position-finder observers, telegraphists, and telephonists, who would be trained men of the district establishment, of depression range-finder detachments, and of orderlies, trumpeters, and signallers as required. Sub-Commanders for fire control, with their staffs, and Sub-Commanders for discipline, would also be included under this heading.

The "permanent fort staff" is the next heading. This consists of the master-gunner and his assistants who are in charge of the equipment of the fort, of the district gunners and artificers; the master-gunner would be on the gun floor and the district gunners in the artillery general store, and other stores and side-arm sheds, and in charge of the lamps for lighting magazines and passages; these men belong to the district establishment or are specially detailed for the duty from R.A. Companies.

"Detached armament and other details" include the officers and men required for groups of movable armament stationed outside the fort, and electric light details.

The "group details" consist for each group of a Group Officer and the detachments for the guns of the group, and one or more dial numbers. Each detachment must, of course, include a N.-C. officer as gun Captain, and at least one trained layer.

Lastly comes the "ammunition detail" under the Ammunition Officer.

The manner of drawing this out depends on the mode of supply to the guns. Guns may be supplied from expense stores and magazines, these being filled up from time to time from the main magazine and shell store. In this case from one to four men will be required in each store, &c., according to the number of guns to be supplied and the weight of the ammunition to be handled. One man should be specially told off to have charge of the supply of tubes and fuzes where these are kept in expense shell stores. At least one man must be posted at the top and bottom of each lift, who will send and receive all messages from the gun floor; and, if the lifts are some distance from the stores, a sufficient number of men must be at the bottom to ensure a constant supply of ammunition. In some cases guns may be supplied direct from the main magazine and shell store. More men may then be required as the guns will be further from the stores or lifts, but the actual number will vary greatly with the nature of the work.

In either method of supply where one lift has to serve many guns, it will be difficult to arrange for an equally rapid delivery to all of them, and this would be fatal to rapid fire; since groups are usually fired by salvos the slowest loading guns would delay the others. To obviate this, temporary depôts are established on the gun floor, out of danger of chance shots, where a few shell can be stored. (*Vide* Manual of Garrison Artillery, Vol. I., page 50, "For precautions to be observed to minimise risk of explosion.") Depôts for cartridges may sometimes have to be similarly established. These depôts must be kept filled from the lifts or main stores by men detailed from the ammunition detail. With guns whose cartridges are brought up in zinc cylinders, a few men must be told off to collect and stack them out of the way of the working of the guns. The responsibility of the ammunition detail extends as far as the delivery at the depôts or at the head of the lifts, the service thence to the guns being carried out by the gun detachments. A N.-C. officer should be told off to superintend the filling up of depôts from lifts, as the Ammunition Officer, being on the magazine floor, will not be able to do so.

If any men of the companies told off to man the work are available after these details are completed they will form the reserve and be placed under the orders of the Sub-Commander. They will be employed in bringing up spare stores as required, in replenishing expense magazines and stores from main store, &c., if necessary, and from their number casualties among the details will be replaced.

If a long bombardment is expected, arrangements would have to be made and noted on the manning detail for relieving at least a part of the details at stated intervals.

To enable every man to know and recognise his post, and to facili-

tate the supply of ammunition and stores, each group has a letter and symbol allotted to it, the letters commencing with the group on the right of the work, and the guns are numbered from the right in each group. Each gun is marked with its group symbol and letter, and its number in the group. Every store, side-arm shed, lift, speaking tube, &c., which is allotted to the service of a group is marked with the symbol and letter, and if to a particular gun or guns with their group numbers in addition ; every article belonging to a gun should be marked or be placed under a label with the symbol and number on it. The route which ammunition should follow should be shown by arrows, accompanied by the same marks, also the way to side-arm sheds, &c.

The various details are paraded at the alarm post in the formation best suited to the ground, the gun detachments being told off previously to marching off. The ammunition detail should be first moved off, then the Fort Commander's staff, lastly, the group details in succession. This is because the ammunition detail will take the longest time to get ready, as some of them will have to change into magazine clothing. The staff will have to get their instruments ready, and all this must be done before the guns can be fired. When details are marched into works with which they are not acquainted, guides must be detailed from the permanent staff to show them the way to their posts.

Troops have sometimes to be sent by boat to man forts and cannot be told off beforehand, it would cause delay to wait till successive boat-loads had all landed before distributing the men, and in that case it would be found convenient to have painted on a wall at or near the landing place a sort of epitome of the manning table, for instance, a a part might read as follows :—

(*A*).	(*B*).
1 Officer.	1 Officer.
2 9″ R.M.L.	4 10″ R.M.L., &c.
1 Dial.	1 Dial.

Supposing the ammunition detail to have been completed the officer in charge of the next boat-loads that arrived would see that two detachments for 9″ were required and a dial number, and would parade sufficient men for that purpose and march them into the work. The (*A*) group mark would then be chalked out, and the next officer would fall in his men opposite (*B*) group symbol and march off as soon as he had sufficient men to make up the required detail, and so on.

Previously to manning, orders would be issued as to the disposal of removable bulkheads, beds, bedding, and barrack furniture from casemates ; the men's carbines and belts should be disposed in the racks so that each man could find his own at once should an assault render it necessary to resort to their use.

Hand lamps should be provided for reading elevation and training, and lighted as soon as the guns are manned, care being taken at night that their light does not show through the ports. These lamps will be required in casemates even by daylight when the smoke becomes very thick.

The permanent staff do not parade with the details, but on the sounding of the assembly would proceed to their stations, light the magazine lamps, open stores, and prepare to issue stores.

The next division of this part of the subject was the storage and supply of ammunition. Beyond what has been said above on these points, it should be noted that Palliser shot and case shot are stacked on the gun floor between or in rear of the guns, shell filled and plugged are stored in main and expense shell stores and cartridges in zinc cylinders in main and expense magazines; when the expense magazines are damp they are sometimes left empty; but in view of a possible attack (which might at distant stations be the first intimation of the declaration of war) the cartridges must be in them, and being in air-tight cylinders it is difficult to see how they could take any harm. Automatic gas-checks and wedge-wads are usually kept in the artillery general stores. Tubes and fuzes are kept in expense shell stores, or in cupboards inside the head of the shell lifts.

Ammunition is arranged in the magazines in batches (called ammunition groups) according to the age and brand of powder or mark of shell. It is most important that this should be properly carried out as different batches of cartridges will not give the same muzzle velocity, and consequently ranges will differ and the correction of elevation would become impossible if batches are used indiscriminately. Batches must consequently be distinctly marked with their number so that they can be easily distinguished in a dim light. They must also be so arranged in the magazines that the guns of a group may all be supplied with the same batch for an equal number of rounds. In action it would be the duty of the Ammunition Officer to select the batch to be issued, usually the largest would be first used, though at peace practice small batches may require to be used up to prevent accumulations.

In allotting lifts and stores to the service of groups or special guns, the principle kept in view is that the supply to every gun of a group should be equally rapid. If it can by any means be avoided a lift should not be allotted to guns of different groups or of different calibres; this will not be quite so important, however, if temporary depôts are established, as less risk of confusion and error in taking up ammunition to the guns is then likely to occur.

Recesses for a few cartridges or shell are sometimes provided in the parapets; these would be filled in anticipation of an action, but this ammunition should not be used except in an emergency, such as the break down of a lift, or the sudden necessity for very heavy fire.

The means of communicating orders, indicating objectives, and finding and communicating ranges, &c., must be the next care.

For communicating orders no special means are at present provided but probably will be shortly; in the mean time orders must be sent by word of mouth through speaking tubes or telephones, or where these are not available by a combination of trumpet calls and flag signals, a code for this is given in the "Tactical Manual," but whatever signals are adopted they should be clearly understood by all concerned, and they should be so arranged that they cannot be mistaken for one another. The most important orders to be communicated are those

with regard to the ammunition to be used and the rate of firing, and the orders to commence and cease firing. If orders have to be sent by orderlies they should be sent on the authorised message form, properly addressed, and with the hour of departure entered, officers receiving them should initial them and mark time of receipt.

For indicating objectives various instrumental systems have been proposed, but none have been so far adopted, an objection to such systems is the introduction of additional instruments, requiring highly-trained men to work them, and the loss of time in taking the observations. The system of indicating by squares seems so far to have given the best results. In this system all the charts of the sea area are divided up into squares of 400 yards side and numbered. On the Section Commander's chart the squares on which the groups of a given fort can bear are marked with a band of colour, each fort having a colour allotted to it, and the band is made darker or lighter according to the number of groups that can bear. The chart being fixed under the position-finding instrument at the Section Commander's station the pointer attached to the instrument shows in which square the object is when the telescope is directed on it. The Fort Commander's chart is similarly divided and numbered, and the squares show the groups which can bear on them; and if he has a position-finder at his station the chart is mounted under it, then, by bringing the pencil over a given square and looking through the telescope, any object in that square will be seen. A similar chart is mounted under each position-finding instrument.

When guns are fought by depression range-finder the Group Officers and depression range-finder observers are supplied with cards showing the range and training to the centre of each square on which they can bear. Electric-Light Officers are supplied with similar cards. The system of using these charts and cards is as follows:—The Section Commander's observer picks up the object with the instrument and notes on which square it is; the number of the square is telegraphed by the Section Commander to the Fort Commander the fire of whose fort he wishes to direct on that object; this number is passed on by the Fort Commander to Group Officers and to depression range-finder observers, who, by aid of their cards, direct the guns and instruments on the square, and are so made acquainted with the object on which fire is to be directed.

As regards the means of finding and communicating ranges, the instruments in use for coast batteries are the position-finder and the depression range-finder, and it is only with these that ranges to moving objects can be sufficiently quickly and accurately taken; though, of course, any range-finder available could be used for a standing object, or from a high battery the angle of depression could be measured by laying a gun on the object, point blank, and measuring the angle of depression with a clinometer, using the formula

$$\frac{\text{Height of gun in feet} \times 1146}{\text{Minutes in } \angle \text{ of depression}} = \text{Range in yards.}$$

The position-finders are worked by specially trained men of the

district establishment; the instrument communicates electrically the range and training to dials fixed near the guns, and are there read off by the dial number. The depression range-finder requires a detachment of three, the observer follows up the object, keeping the cross-wires on the water-line at the bow, or if that is not visible at the stern (gun-layers are instructed to lay on the same points), the drum-reader reads out the ranges as they alter at such intervals as the Fort Commander directs, usually every 50, 100, or 200 yards; and the dial number adds or subtracts, from the range read out, the correction ordered by the Fort Commander and shows the corrected range on the dial. This range is copied on the group dials as often as it changes, and the dial numbers should be trained to do this as quickly as possible; if any delay occurs, and especially if the delays are irregular, inaccuracy of shooting must result.

If the Fort Commander orders a correction which is an uneven multiple of 25 and the ranges are read from the drum at the 50 and 100 yards graduations, the dial will show ranges ending in 25 or 75, this will make it likely that they will be wrongly read by the group dials, and the Group Officer's correction for displacement will not be so easily made, it would then be better that the ranges should be read out at the intermediate graduations; thus if the ranges read out are 1800, 1850, &c., and the Fort Commander's correction is + 75, the ranges shown would be 1875, 1925, &c., but if the ranges are read out at 1825, 1875, &c., the dial would show 1900, 1950, &c. Of course, the Fort Commander's dial must not be so placed that the range could be read from the sea.

In some cases electric dials similar to those used with position-finder are supplied, this is a great improvement, the dial number has then only to watch his dial and read out the range as it alters.

The possibility of obtaining accurate shooting depends on the accuracy of observation of the results of fire, and correcting subsequent rounds accordingly.

At peace practice, by the aid of look-out parties, plane tables, &c., this can be very accurately done, but under service conditions, such as a rapidly moving target covered at intervals by its own smoke and with, perhaps, several forts firing at it, such assistance could not be relied on. It would be better to train officers to judge the results of their fire without such extraneous aids, and it is much to be regretted that, owing to the small quantity of ammunition available, so few have a chance of such training.

With the position-finder, when the splash of the shot can be seen, the error in range and direction can be quickly ascertained by the instrument.

With depression range-finder also the error in elevation can be obtained by taking the range to the splash; it is very desirable that a second instrument should be provided at the Fort Commander's station for this purpose.

The possible modes of attack of the fortress, having regard to the probable strength and composition of any fleet that might be brought against it, would be considered, and the best mode of resisting each

such attack laid down. Instructions, based on these schemes of defence, would be issued to Section Commanders and Fort Commanders to guide their action.

All information as regards the organisation and the schemes of defence are kept in record books.

In every fort there is such a book kept up to date, and giving full details on all the points which have been mentioned, besides others, such as barrack and camping accommodation for the garrison, water supply, facilities for landing men for reliefs, &c., position of mine-fields, with ranges and trainings from the guns told off for their defence, positions for movable armament with ranges to landing places, &c., position and ranges to datum points for position-finder and depression range-finder instruments. Also details of the armament and spare stores, capacity and contents of magazines, &c. Also the object of the work in the scheme of defence and its relation to other works, and the action to be taken when attacked.

Accompanying the record book would be a detailed plan of the fort showing the grouping of guns, allotment of lifts, &c., to the groups and position of all fighting stations, &c. A chart of the sea area copied from the Admiralty chart would give on it all information with reference to height and set of tides, depth of water channels, position of five and three-fathom lines, and should have marked on it the arcs of fire of the guns and their extreme ranges, also any directions in which it would be dangerous to fire for fear of damage to friendly works. There should be marked ranges to datum points from position-finder and depression range-finder stations, and ranges from guns to conspicuous objects to centre of channels and to five fathom line in given directions; also limits of range of electric lights (this is not much more than 2000 yards under favourable conditions, rapidly diminishing with the presence of mist or smoke).

There would be also a map of the land covered by the fire of the fort, if any, with similar information on it, to enable fire to be opened as speedily as possible at known distances. In the Fort Commander's station must also be provided lists of foreign ships arranged under "types," with description and directions how to employ the guns of the fort to greatest advantage against each type (*Vide* "Fire Tactics"), and tables for correcting range and deflection when depression range-finder is used (*Vide* "Fire Control.")

Similar books and charts are provided at the Section Commander's station dealing with the whole section, and containing instructions for fighting the section against squadrons of different strength and composition; also lists of foreign vessels, giving descriptions by which they may be recognised, and showing roughly what each fort would be capable of doing if ordered to attack them.

(*To be Continued.*)

A SUGGESTED IMPROVEMENT IN MOUNTAIN ARTILLERY TRANSPORT.

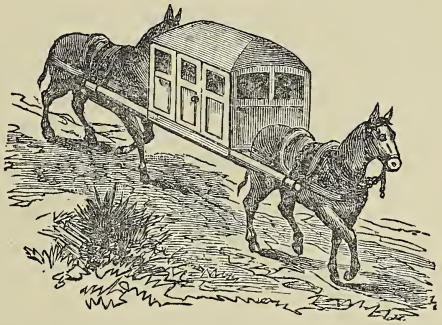
BY

CAPTAIN F. R. MAUNSELL, R.A.

THERE is a description of transport in use at the present time in the East a short account of which may be of interest. The idea has not been tried in recent years, as a means of military transport, but there seem to be several good points about it, and for Mountain Artillery work, where heavy weights have to be carried over a country too difficult for wheeled traffic, it seems specially suitable.

The carriage referred to is known in Persia as a "takhtrewan" or travelling seat, and consists of a strong wooden framework, on which is erected a carriage in which the passengers sit. The side pieces of the framework form two pairs of shafts, one projecting to the front and the other to the rear. (Fig. 1.) Two horses or mules are used,

FIG. 1.



the leader travelling in the ordinary manner in the front pair of shafts and the other facing in the same direction harnessed in the rear pair. There are no wheels, and the whole weight of the carriage and articles carried is distributed between the two animals by the backbands, which rest on pack saddles. Traces are not used, and do not seem to be required.

A previous instance of such a system of draught being used for military purposes is in an account given in the R.A.I. "Proceedings" of January, 1883, of the operations in Egypt in 1801. This method of carrying stores is there described as a horse-barrow. The carriage used was something similar in shape to the ordinary hand-barrow, but larger. Two horses or mules were used, each having a

small cart-saddle girth, backband, breastplate, and crupper; such barrows were found useful for narrow paths and the trenches of the attack, or for conveying any individual weight too heavy for a single horse; such as a small piece of ordnance, standing carriage, large casks of provisions, &c. The system seems to have been used with considerable success during the expedition, as further designs were formed for a double barrow consisting of three shafts to be carried by four horses in pairs, but neither time nor materials admitted of their being put into immediate execution. The "takhtrewan" now used in Persia and Turkey is employed in parts of the country where wheeled transport is quite unknown and where pack transport, in which camels, horses, and mules are used, is the universal method of moving goods from one place to another. The principal use of the "takhtrewan" is to carry passengers, and in this respect corresponds to the palanquin in use in India, with the exception that horses are used instead of coolies. The carriage designed for this purpose consists of a strong lower framework supporting the body of the vehicle, which has two sliding doors and two small windows at either side. The dimensions of the body of one of these carriages measured 6 feet long, 3 feet 6 inches broad, and 5 feet to 5 feet 6 inches high, with an arched roof on the top.

The shafts project at either end for 5 feet, making a total length of 16 feet for the whole carriage. The shafts are shod at the ends with iron, to which are fixed loops used as fastenings for the backbands, which consist of short lengths of chain.

No special harness is used, the ordinary Arab pack-saddle being placed on the mule's back and the chain put over it.

This particular kind of pack-saddle is higher at the ends than in the middle, so that there is no tendency for the chain to slip to the rear. The pack has a breeching and breast-plate, which keep it in its place. Two people ride in one of these "takhtrewans," but the motion is decidedly unpleasant, and on a rough road resembles that of a ship in a storm.

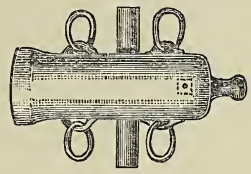
Besides being used for carrying passengers, this mode of transport is employed for carrying large articles which it would be inconvenient to divide into suitable loads for single pack animals. In such a case there is no carriage, but simply a wooden platform or barrow with the shafts projecting at either end, on which is fastened the article required to be carried.

In one instance a caravan was met in which one of the loads was the body of a large brougham without its wheels, which was being carried in this fashion by two horses. The brougham was fastened to a roughly-made platform, and was wending its way up a very rough mountain pass, and seemed to travel easily and well. I can only guess at the weight of such an article, but, including the framework, it would be 8 or 9 cwt. There were no spare horses, and it travelled the ordinary stages.

Perhaps a more interesting example of this mode of transport was in the case of a gun met with in a hill fort. The country round was entirely without roads suited for wheeled traffic and very mountainous,

and the gun was specially designed for transport in this manner between two horses. It was a smooth-bore bronze howitzer, without any date or place of manufacture marked on it; the calibre was $5\frac{3}{4}$ inches, and its length without the cascable was 3 feet 6 inches. Its chief peculiarity was that it was cast with four loops, two in front and two in rear of the trunnions, in which were placed large iron rings. Poles could be passed through these rings one on each side, and the gun could be transported by two horses over almost any country. (Fig. 2.)

Fig. 2.

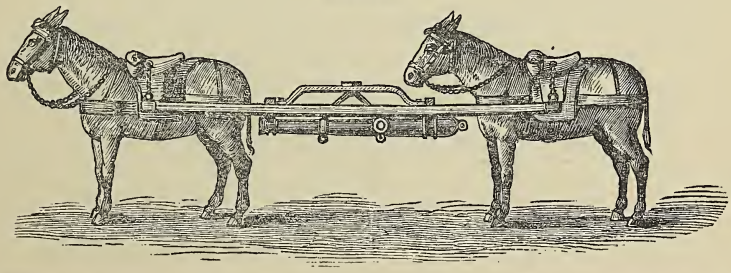


The exact weight of this howitzer was not to be found, but by comparing it with the 24-pr. carronade of 13 cwt., which it somewhat resembles in general dimensions, its weight would probably be about 10 cwt. It was much scored with firing, and had been re-vented with an iron vent about two inches square, and possibly the last occasion which arose for its use was in an attack on the place in 1842.

At the present time, when efforts are being made to increase the power of the mountain gun in our service, this method of transporting a gun over a hilly country would appear to be well worth a trial, and there is no doubt that if found suitable a much heavier piece could be brought into the field for mountain warfare. The necessity for having a jointed gun would be done away with, which in itself would be a considerable advantage. The rough clumsy framework in use in a "takhtrewan" could be lightened and improved. The shafts could be made of wood and fastened to a light steel framework, with loops to support and secure the gun while travelling. The carriage, with its wheels and the ammunition, could be carried on other carriages specially constructed to receive them.

The best method for the gun to travel would be with its muzzle to the front and parallel to the line of draught (Fig. 3); the length of

Fig. 3.



the 400-lb. jointed-gun is $70\frac{1}{2}$ inches, or about 6 feet, which would not be an excessive length. The objections to be urged against such a

mode of transport is that it would be unsuitable for very rough country, for turning sharp corners or descending a sudden drop in the track. It has the advantage, however, that the centre of gravity of the load is very low and the tendency to upset is very small, being less than that of a single pack animal. Also the main roads in Persia, along which goods are carried in "takhtrewans," are for steepness of gradient and roughness difficult to beat in any country and it is surprising sometimes to see how the two horses can manage to pick their way along in safety. To bring a gun into action could be done very rapidly by running the carriage directly underneath the platform, and lowering the gun into the trunnion holes. The shafts should be made to terminate at the loop to which the backband is attached so that the length of the whole platform should be as short as possible to facilitate turning corners.

Fig. 3 represents a gun 6 feet long carried on a platform between two mules as suggested.

To divide the weight of the gun equally between the two animals it is arranged to be supported by a pivot in the centre of the platform. The breech and muzzle of the gun could be fastened by straps to the cross transoms of the platform to prevent swinging about when travelling.

It would shorten the length also considerably if it were possible to carry the gun in a transverse position with its axis at right angles to the line of draught, but with a gun nearly 6 feet in length, similar to the 7-pr. and 15-pr. jointed-guns, this would probably occasion a block in a narrow road.

The advantage of using as powerful a gun in mountain warfare as the means of transport will allow can scarcely be over-estimated, and it seems a distinct advantage to have a means which enables a gun or short howitzer to be carried complete instead of in two or three sections. This system of draught is already well-known, but there seems to have been no trial of it for the transport of Mountain Artillery for which it seems very suitable. Judging from the facility with which a Persian "takhtrewan" can be managed in a narrow pathway, the difficulty of turning corners and going up and down steep slopes would not be so great as appear at first sight.

FIELD ARTILLERY FIRE.

BY

CAPTAIN W. L. WHITE, R.A.

(School of Gunnery Shoeburyness).

CHAPTER VII.

Distribution and Concentration of Fire.

The systematic distribution of fire with a given object and in a regular manner has been developed *pari passu* with improvements in projectiles and increased accuracy in the shooting of guns.

When solid shot were fired from smooth-bore weapons the practice was so inaccurate and effect so difficult to obtain that the concentration of a large number of pieces against a single gun or against a very small portion of the enemy's line was always resorted to whenever the ground and the position taken up permitted. But with the introduction of shrapnel shell, the effect of which is not so local as that of solid shot, commenced the distribution of fire, in order to obtain a good effect over a large portion of the enemy's front at the same time.

The effect that it is desired to obtain is not only the material effect of killing, but also the moral effect which brings about unsteadiness of aim and slackness of service of guns and rifles; the following extract will show how great the influence of this moral disturbing effect is: "During the war of 1877 the Turks made great use of repeating arms. They inflicted loss at ranges over 1500 yards. The greatest losses inflicted were between 1500 and 500 yards, after that less as they would not show themselves above the parapet."—*Kroupatkin.*

Foreign authorities appear to be agreed that, if two artilleries engage one another, the one which first finds the range and commences a distributed fire will so derange the shooting of the other batteries that they will never properly find the range at all.

To arrive at this desired effect rapidly it has been determined that, when a ranging point has been selected, fire shall be distributed from the time of firing the first shrapnel. No doubt it is rather more difficult to observe for length of fuze when the fire is distributed over an extended front, but at this critical phase of the fight everything must be subordinated to the pressing circumstances of the moment. When no ranging point is required, that is to say against targets with extended and continuous fronts, where observation is easy, the fire may be distributed from the very first round.

The amount of front that may be covered by thoroughly effective fire from a six-gun battery is about 150 yards. That is to say, the breadth of the cone of dispersion is, on the average, about 25 yards where the axial bullet strikes, and six times this amount gives the front

that can be covered. By bursting the shell further back from the target a greater front can be covered, but the effect produced is not so complete on account of the bullets being more scattered.

There are three kinds of distribution to be brought under review, viz.: Distribution in Breadth, Height and Depth. The first two have identically the same design of disturbing, and if possible subjugating the enemy's fire over his whole front.

Distribution in breadth. This is the most common form and is for application against extended fronts. When applied to artillery the most usual form is to distribute the fire gun to gun; the case of there being a superiority on one side will be noticed later on. When applied against an infantry or cavalry target a certain portion of the target is allotted to each battery and this is carefully pointed out to the gun-layers, who then divide it among themselves without further direction, according to the situation of their guns in the battery.

This being the most common form of distribution it should be the most often practised at drill. Gun-layers should be taught that a distributed fire is the normal condition when once ranging has been completed, and therefore when the first shrapnel is put into their guns they should at once turn away from the ranging point on to their own particular portion of the target; this they are often unwilling to do and will not do so without constant supervision until the habit has become thoroughly ingrained in them. There is a word of command in the drill-book to "Distribute the fire" which appears unnecessary, as everyone should be taught to do so as a matter of course; if any word of command is necessary it should be when it is not desired to distribute the fire.

Distribution in height. This form is applicable in the attack of buildings or of troops in tiers of shelter-trenches and has the same object, a disturbing effect over the whole front at once. The only example that can be quoted is that of the first battery that arrived to assist in the attack on the Chateau of Geissburg, August 4th, 1870, which "was told off by sections to shell the different stories of the building." (Official Account, Translation, Vol. I., p. 133).

In firing at a captive balloon it will also be sometimes necessary to distribute the fire in height for it is a common practice to slowly raise and lower the balloon, at the same time moving the wagon to which it is attached, in order to baffle the fire directed at it. The Battery Commander, having ranged with time shrapnel (the assistance of an observing party being indispensable in this case) should order the Centre Section to take the elevation found, the Right Section a degree more and the Left Section a degree less, aim is taken at the car of the balloon and fire is by salvos.

Distribution in depth. This form of distribution is applicable in the attack of woods and villages and has for its object the driving back of the enemy to such a distance within his position that he shall not be able to return to the front edge before the attacking infantry arrive there.

Colonel von Dresky gives a graphic account of the attack on the copse in front of la Folie Farm on August 18th, 1870. The lisière of

this wood was held by the French who were subjected to a tremendous cannonade by the Corps Artillery of the III Corps and others, distributed along the whole front of the wood. This fire had the effect of driving the French some 100 yards back into the wood, but when the cannonade ceased and the German infantry attempted to advance from the neighbouring Bois de Genivaux to the Folie copse, the French resumed their positions along the lisière and completely repulsed every attack directed against them.

A few days later, at Sedan, on September 1st, 1870, the correct method of attacking infantry in a wood was illustrated and is thus described by Prince Kraft in his IVth Letter on Artillery in speaking of the attack on the Bois de Garenne: "... masses of infantry crowded together in this wood ... I divided the long edge of the forest, which extended before us, into sections, and I assigned one section to each of my batteries. The first gun of each of these units was to fire at the very edge of the wood and each of the following guns was to fire in the same direction but was to give 100 paces more elevation than the gun on its right. In this way the edge of the forest and the forest itself, to a depth of 500 paces, would be covered with a hail of shells. The splinters would carry yet further."

This same method of procedure is equally applicable to the attack of villages, for by it the garrison of the front edge of the buildings, which is held in reserve in rear of those buildings while the preparation of the attack by the artillery is going on, would be driven further and further back into the village and would give a chance to the attacking infantry to get close in before the front prepared for defence could be re-occupied.

Concentration of fire. The necessity for the concentration of fire against a so-to-speak mathematical point, such as a single gun, has disappeared with the introduction of shrapnel shell and accurate weapons, but the necessity for the concentration of fire against a tactical point still remains, and, as bringing the greatest force to bear on a decisive portion of the enemy's line, is one of the highest exhibitions of the skill of the tactician.

Such is the deadly effect of modern weapons that, unless we possess a superiority in numbers we cannot afford to concentrate our fire on single guns leaving others undisturbed, the practice of these latter would become too good.

We shall thus have to deal with instances where a superior force of artillery is brought to bear against an inferior. When this is the case it is laid down that the superiority of force should be used against the enemy's flanks by outflanking and bringing an oblique fire to bear on one or both of them, his fire is thus silenced progressively from one or both flanks. To take an illustrative case of the distribution of fire of more than one battery against a small target, let us suppose that two batteries are told off to engage a single battery of the enemy, standing on the flank of a line of artillery.

Ranging. One battery would find the range for both, and the other verify it; or, if the enemy's guns were sufficiently far apart, each battery might have a ranging point in an opposing half battery.

Distribution of fire. Each battery should distribute its fire over the whole front of the opposing battery. If each battery were only to engage the half battery opposite to it and a new target were suddenly to appear, on which the fire of the outer battery had to be turned, then the second battery would have to re-distribute its fire, perhaps re-arrange its auxiliary laying points, or else certain of the enemy's guns would be left unmolested. Whereas, if each battery distributes its fire over the whole front of the opposing battery from the first, it is possible for the fire of one battery to be turned off without deranging the fire of the other.

Selection of projectile. In order to avoid as much as possible the confusion arising from several shell falling about the target simultaneously it is usual, when two batteries fire at the same small fronted target at the same time, that one should use percussion and the other time shell in order to facilitate the general observation of the fire. It is always the battery that stands on the outer flank of the line that should fire percussion shell because it is that battery which will most probably be required to find the range to new and suddenly appearing targets and, if it is loaded with percussion shell it is always ready to do so.

CHAPTER VIII.

Supply of Ammunition.—Rates of Fire.

In order to thoroughly appreciate the system of ammunition supply in the field it will be necessary to study the organisation of an Army Corps, which, in our service, is as follows:—*Vide* Field Army establishment, service abroad, issued with Army Orders dated 1st August, 1891.

1st ARMY CORPS.

	1st Division.	2nd Division.	3rd Division.	Corps Troops.
Infantry	1st Brigade. 2nd Brigade.	3rd Brigade. 4th Brigade.	5th Brigade. 6th Brigade.	1 Battalion.
Artillery	3 Field Batteries	3 Field Batteries.	3 Field Batteries.	3 Horse Batteries. 2 Field Batteries.
Cavalry	1 Squadron.	1 Squadron.	1 Squadron.	1 Squadron.
Ammunition Column ...	Infantry Div. Ammunition Column.	Infantry Div. Ammunition Column.	Infantry Div. Ammunition Column.	Corps Troops Ammunition Column.
Ammunition Park.	1st Section.	2nd Section.	3rd Section.	4th Section.

Note.—The 5th Section of the Ammunition Park works with the Cavalry Divisional Ammunition Column.

The Divisional Ammunition Columns, taking into account artillery ammunition only, each consist of 6 ammunition wagons with limbers, 6 ammunition and store wagons, and 1 spare carriage, and the ammunition carried by them is meant for the guns of the division to which the column belongs.

The Corps Troops Ammunition Column consists of 10 ammunition wagons with limbers, 10 ammunition and store wagons, and 4 spare carriages, and is meant for the supply of the batteries of the Corps Artillery. This column, therefore, stands in the same relation to the Corps Artillery as the Divisional Columns do to the Divisional Artillery, that is, they contain the first and nearest means of replenishment of the limbers and wagons of the batteries.

Although certain columns belong to certain divisions it is in no wise intended that any column should refuse to supply ammunition to any batteries requiring it.

The 1st, 2nd, and 3rd Sections of the Ammunition Park each consist of 9, and the 4th Section of 15 ammunition and store wagons.

A Cavalry Divisional Ammunition Column consist of 12 ammunition wagons with limbers and 1 spare carriage carrying 75 rounds a gun for each of the two batteries of the Division. The 5th Section of the Ammunition Park consist of 6 ammunition and store wagons conveying 72 rounds per gun for each of the above batteries.

The ammunition actually carried for each gun of an Army Corps is as follows :—

	Common shell.	Shrapnel shell.	Case shot.	
Gun-limber	8	24	4	Total number of rounds per gun.
Wagon-limber	8	24	4*	
Wagon-body	4	32	†	
Total with Battery ...	20	80	8	108
With Infantry Divisional Ammunition Column for Divisional Artillery, or with Corps Troops Ammunition Column for Corps Artillery				74
With the Ammunition Park				72
Grand Total				254

* In preparing for action two of these case shot are taken out of the wagon and are placed upon the gun.

† In the off box of the wagon-body there are in addition two star shell, but as these are not man-killing projectiles they have been omitted from the calculation.

The common, shrapnel, and case carried in the reserves are in the same proportion as those carried with the battery ; viz., one common to four shrapnel.

The above figures are to all intents and purposes correct, omitting

fractions and star shell, except that the Corps Troops Ammunition Column actually carries 75 rounds per gun instead of 74.

The systems to be brought under notice are :—

1.—Direct supply from limbers, which are repacked from the wagons.

Advantages.—Although this system is one that has been officially adopted in our service for many years, and still appears in the "Artillery Drill-Book," it is extremely difficult to point out any advantages attaching to it. Its retention doubtless arose from habits inculcated during a period when batteries on peace establishments were not supplied with wagons and officers preferred to depend in war on a system of service from the limbers which they had practised in peace.

Disadvantages.—Are numerous.

The gun teams, if not unhooked, are the more certainly exposed to those heavy losses, which, times out of number in modern warfare, have temporarily deprived whole Brigades of the power of movement; if unhooked the battery is not in a position to move on at the shortest possible notice.

In the case of Horse Artillery acting with Cavalry the supply will generally have to be made from the limbers, but, as a rule, these batteries would not be subject to heavy fire, so the above remarks do not apply to them.

There is a great waste of labour in the shifting of ammunition from wagons to limbers, for which purpose, if the supply in the limbers is not to run dangerously low, some of the wagons must be driven up to the limbers, close in rear of the fighting line, at least three times in the hour, and remain there some 10 minutes each time while the repacking goes on, thus needlessly exposing a large number of men and animals other than those in the actual fighting line.

2.—Supply from wagons.

Advantages.—The supply in the limbers is kept as a last reserve, to be resorted to on the exhaustion of other supplies, or when losses among teams render it no longer possible to supply from more retired échelons, the battery can thus never be without ammunition until every possible round with it has been fired.

By first exhausting the ammunition in the wagons these can be sent off sooner to the Ammunition Columns than if the supply in the limbers were first exhausted and then replaced by that from the wagons.

It permits the limbers and gun teams, in fact all teams, to take full advantage of any neighbouring cover within reasonable distance of the battery, or, at all events, to be withdrawn from the line of fire directed on the guns, and thus, by protecting the teams, preserves the power of moving forward at the shortest possible notice, and that, too, with at least the limbers full of ammunition for immediate use.

The foregoing advantages most decidedly claim a judgment in favour of a system of supply direct from the wagons. The only question that appears to excite any difference of opinion is :—Should the supply be made from two or three wagons brought up at the same time ?

The only advantage presented by a two-wagon system is that two wagons being sooner emptied than three, the first échelon of empty wagons is sooner despatched to the Divisional Reserve, and the renewal of supply thus begins at a slightly earlier period than if the first échelon of wagons had to wait until three wagons instead of two were empty before starting for the Divisional Reserve. Against this advantage may be ranged the following disadvantages, which show a balance in favour of a system of supply from three wagons.

With two wagons, one of them must be placed in rear of the centre gun of each half battery, and, to allow for recoil and also for limbering up, some distance in rear of that gun; from this it comes that :—

a. The battery has unnecessary depth, and thus presents a more vulnerable target. With the three-wagon system this is not the case and the wagons one per section, can be brought almost into line with the guns.

b. The ammunition supply numbers from the two flank guns of half batteries would repeatedly have to cross a large interval under fire, an ordeal which, experience has taught, they are extremely averse to facing. These large intervals, and also the distance mentioned in the preceding paragraph, increase the labour of bringing up ammunition to the gun. With the three-wagon system this interval and distance is reduced to a minimum, indeed the wagons may be so close to the guns that it is a matter for consideration whether, under some circumstances, the services of No. 4 might not be dispensed with, at all events he would be under cover of the wagon-limber instead of being in the open as heretofore.

The following three-wagon system, which has been adopted in India, has been tried at Okehampton in 1891, and found to give satisfaction.

TENTATIVE SCHEME FOR OKEHAMPTON, 1891.

(AS TRIED AND RECOMMENDED FOR ADOPTION IN INDIA.)

The following scheme is based on the fact that artillery fire is accurate as regards line, but comparatively unreliable as regards elevation, hence the safest formation for a battery exposed to artillery fire is the thinnest possible line, and the carriages supplying the ammunition should be approximately in line with the guns, while the limbers, etc., should be kept either under cover, or, if in the open, beyond the dangerous zone of well-aimed shrapnel fire. It is also considered that, in open positions without cover, unless the teams are sent out of the battery, the losses among the horses would probably be sufficient to prevent the battery from advancing again.

First Stage.

When the battery prepares for action the three right wagons of sections form up in rear of and covering their guns. These wagons conform to the movements of the battery, following as rapidly as the ground will admit, but never faster than a trot. The three left wagons

of sections form a second line and follow about 700 yards in rear, but, if possible, out of fire. When the battery comes into action, if the wagons are up with the guns, the limbers at once drive away; the wagons pass between the limbers and drive up, each between its own section, five yards in rear of the trails of the guns. Care must be taken not to advance beyond the muzzles and so prevent the guns opening fire; the wheel horses are then unhooked, and the teams complete ridden away to join the limbers. These should be sent under cover if any be available near, and if not they should form up at full interval about 250 to 300 yards in rear and in échelon with the guns. The wagon teams form up between the limbers of their own sections.

Should the wagons not be up with the guns when the battery comes into action the limbers remain ten yards in rear of the guns, facing to the rear, and the first few rounds are taken from them, these should be replaced as soon as possible. When the wagons have arrived and have passed between the limbers the latter trot off as above. Should it be necessary to replenish ammunition before moving, the ammunition should be collected in the centre wagon and the teams of the other two should be brought up and hooked in, and they should drive away before the second line of wagons arrives; more than three wagons never being allowed in the battery at one time.

Second Stage.

If the action is likely to be prolonged, or when a second position is to be taken up, the second line of wagons is ordered up to join the limbers and, on the signal being given to limber up, they advance with the limbers, and the battery moves forward with three full wagons and with full limbers. The right wagons of sections, which have supplied the ammunition for the battery while in its first position, remain on the ground, any wounded will be placed upon them and casualties made good from the men carried on them. Their teams now come up, hook in, and these wagons either join the other carriages of the second line in rear or wait for them to come up.

The ammunition expended should now be made good by filling up one or two wagons, if possible, from the third. All empty wagons should, under orders from the officer commanding the second line, be sent back at a trot to the divisional ammunition column to fill up and rejoin as soon as possible.

Third Stage.

If, finally, the battery has to advance into the zone of aimed infantry fire it will do so with limbers only. All wagons should be sent to fill up with ammunition if necessary, rejoin the second line and await orders.

N.B.—Wagon-bodies should first be emptied, since, if a battery is called upon to advance when only the ammunition in the wagon-bodies has been expended, the wagon-limbers will still be full and can, on an emergency, be pushed forward with the guns, leaving the bodies to be picked up as the limbers fall back on the second line when empty. This may be specially useful in the event of batteries being pushed in to within short range of the enemy's infantry at the critical moment of the attack.

There are a few points in connection with the above which demand some further consideration.

No scheme is desirable which involves the unlimbering of the wagons, for this either leads to unnecessary labour in repacking ammunition or to the wagons going forward half full and thus delaying the despatch of the empty échelon to the Divisional Reserve.

Removal of teams.—When teams are removed, the limber or wagon should most undoubtedly be left facing to the front, in order to afford as much protection as possible to the numbers issuing ammunition. When teams are not removed, it is a question whether vehicles should not be reversed, in order to provide as much protection as possible to the teams and thus endeavour to preserve the power of movement to the last.

Since the above paragraphs were written a system of supply from the wagons has been formulated at Aldershot and promulgated in the Instructions for Practice for 1892, p. 24, Q.V. If it be compared with the above it will be seen that it is open to the following criticism.

The three wagons being drawn up *in rear* of their guns the target is unnecessarily deep and the Nos. 4 have a long distance to run, especially those of the guns not covered, who have also a 19 yard interval to cross. If there is no objection to Nos. 4 crossing a wide interval then, for reasons given above, a two-wagon is preferable to a three-wagon system.

It has been objected that a two-wagon system destroys the sectional principle. The sectional principle has nothing to do with it. The attention of Sectional Officers is, or should be, entirely taken up to the front by their guns, it is the duty of the Captain to look to everything in rear of the line of guns, including the ammunition supply, and, as he is not a Sectional Officer, it does not matter to him whether there are two or three wagons to be supervised.

Renewal of the supply from the Ammunition Columns and Park.—When wagons arrive they must be repacked and sent off again to the front with the greatest rapidity; if pressed for time, one or more of the ammunition wagons with limbers from the Ammunition Column may be sent straight off to the battery requiring it without waiting to transfer the ammunition to the battery wagons.

Ammunition carried in the ammunition and store wagons should first be issued in order to keep the ammunition wagons with limbers full, in case they should be wanted in the fighting line in a hurry.

The position of these reserves on the line of march is a matter of great moment, about which, at present, some doubt exists.

In "Field Artillery Drill," Vol. II., pp. 227–228, it states :—

> "As all ammunition reserves will march in rear of the combatant troops it may probably happen that, in the case of an Army Corps marching by a single road, the Divisional Reserves will find themselves, on the eve of an action, a full day's march in rear of their guns."

From the above quotation it must be inferred that Divisional Ammu-

nition Columns are to follow in rear of the whole of the combatant portion of troops on a given road. If this be so, in the case of an Army Corps marching on a single road, the batteries of the leading divisions will almost invariably be left without ammunition for a considerable period of time before replenishment could take place.

The following extract from a lecture by Lieut.-Col. N. L. Walford, R.A., gives a carefully calculated table showing after what lapses of time reserves of ammunition may be expected to become available, assuming (the nomenclature has been altered to suit latest changes):—

That the batteries of the advanced-guard being in action, the order for the other batteries to close up was issued at noon.

That the orderly carrying the above order moved at the rate of 300 yards per minute.

That the Divisional Ammunition Columns march in rear of the combatant portion of troops *to which they belong, i.e.,* in rear of their divisions, and the Corps Troops Ammunition Column followed by the four sections of the Ammunition Park in rear of the combatant portion of the Army Corps.

That other troops on the road will allow guns, but not ammunition reserves, to pass them on the road to the front.

"We find that the times of the appearance of the various units on the field will be as follows :—

1st Divisional Artillery	at 12.25
Corps Artillery	,, 12.50
1st Divisional Ammunition Column	,, 1.12
2nd Divisional Artillery	,, 1.18
3rd Divisional Artillery	,, 2.3
2nd Divisional Ammunition Column	,, 2.53
3rd Divisional Ammunition Column	,, 4.11
Corps Troop Ammunition Column and Ammunition Park	,, 4.30

It is evident from the above that all the Ammunition Columns will arrive within the two hours and forty minutes (during which the shrapnel carried by their batteries will last) with the exception of the Corps Troops Ammunition Column which will not come up until nearly four hours after the mass of the Corps Artillery, or five hours after the batteries of the advanced-guard will have opened fire."

"From this it is evident that the Corps Troops Ammunition Column when an action is probable should march, at the latest, with the 2nd Divisional Ammunition Column."

Assuming the figures in the foregoing extract to be correct, if we follow the indications given in the drill-book, and place the Divisional Ammunition Column as well as the Corps Troops Ammunition Column in rear of all combatant troops on the road, then none of the reserve ammunition would arrive, in the example given, until 4.30, or about the time when the last rounds of the last Artillery which appeared on the scene had been fired, and after the leading batteries and those of the Corps Artillery had been standing without ammunition for about two hours.

The remedy for this oversight is, manifestly, to lay down that, under normal circumstances, reserve ammunition columns are to follow in rear of the combatant portion of troops *to which they belong* and that the Corps Troops Ammunition Column is to follow immediately in rear of the Divisional Ammunition Column of the division marching in rear of the Corps Artillery, the four sections of the Ammunition Park following in rear of the whole of the combatant portion of the Army Corps.

Rates of Fire.—There are three acknowledged rates of fire in every Artillery.

Slow Fire.—In which there is no stated interval between the discharge of the guns, but each gun is discharged in succession on a distinct command from the Battery Commander for each individual gun.

Slow fire is used during the ranging process when it is important that the Battery Commander, or his assistant, should observe each round, and he will not give the signal or command for a round to be fired until he is ready to observe. It is also used in the preliminary phases of an engagement when the ranges are generally very long and it is desired to economise ammunition for the decisive phases of the fight, indeed, whenever it is desired to effect an economy of ammunition it is advisable to revert to slow fire.

Ordinary Fire.—Having once received the order for ordinary fire from the Battery Commander the guns are fired in succession by command of the Sectional Officers, who will allow an interval of from 15 to 20 seconds between each discharge.

Rapid Fire.—The rule is the same as for ordinary fire with the exception that the interval between the discharges is from 7 to 10 seconds. There is a slight variation of this method of fire, viz., when firing against a moving target, it is permissible to give "Rapid fire from the Right (or Left) of Sections." This command is given because it is desired to catch the enemy at or about a certain point and by this more rapid method of fire it is possible to repeat the round while he is still about the same spot. Whenever this command is given the number of rounds that each gun is to fire should be specified. This rate of fire is also suitable when firing case shot, *vide* remarks on page 198, No. 5, Vol. XIX., R.A.I. "Proceedings."

Salvos.—The firing of salvos has been discontinued, except under very special circumstances, by every artillery. The arguments against them are :—

When used there is an undefined feeling of uneasiness among the men because they feel that, all the guns being empty at once, they are for the moment in a defenceless position ; this leads to a hurried reloading and is apt to induce carelessness.

When used against a moving target, if an error in observation has been made the whole salvo may be wasted, it is better then to have rapid fire when some of the rounds are sure to be effective. In any

case of error in observation the firing of salvos tends to waste of ammunition.

Salvos are only permissible in three instances, viz. :—

When firing at balloons.

When the target is so obscured by smoke that it is impossible to observe the effect of a single round, then the simultaneous bursting of six shell may be apparent.

In the attack of an enemy behind cover or behind a screen it is permissible, as stated on page 272, to sweep the ground backwards and forwards with salvos of shrapnel, the effect of a salvo, when the right elevation has been obtained, being more striking than that of six successive rounds, and in this case we are ranging by ear rather than by eye.

Such then are the rates of fire in general use, others, such as the "sprungweisen" or "intermittent" fire of Count Thürheim, might be mentioned, but they have all, after trial, been abandoned for those above-mentioned. Combinations of the above may, however, be made, such as the firing by rapid or ordinary fire right through a Brigade Division, as mentioned on page 270.

Rates of fire must be studied from two points of view, the disciplinary and the economic.

The disciplinary point of view is very simple. It is held of the highest importance that fire should be kept up with REGULAR INTERVALS, for, it is the experience of those who have stood under a heavy fire that, if irregular intervals are allowed the fire gradually gets quicker and quicker until at last, the men becoming hurried and over-wrought, the fire gets out of hand altogether. The discharge of guns at regular intervals has, from its monotony, almost a quieting effect on the nerves, moreover the gunners know exactly how long they have for the performance of their duties and are not likely to become flurried. As with the rate, so with the succession of fire; the succession of fire should never, without very good cause, be disturbed; it is held abroad that a disturbance in the succession of fire or irregularity in the intervals between the discharges is the first sign that the battery is suffering and that the fire is beginning to get out of hand.

The economic point of view is as important. If the amount of ammunition carried with a battery be studied, it will be seen that of shrapnel there is with every battery sufficient to carry on fire for the following periods :—

Ordinary Fire,	20	seconds	interval	...	...	...	2	hours	40	minutes.		
„	„	15	„	„	...	...	...	2	„			
Rapid	„	10	„	„	...	...	...	1	„	20	„	
„	„	7	„	„	...	...	...			56	„	

The above includes, of course, the ammunition carried in the wagons. If this table be studied in conjunction with that on page 328, which shows approximately when the Ammunition Columns may be expected to arrive, the importance of a regular rate of fire will be appreciated. If an officer indulges in the luxury of rapid fire, or, by not having

good fire discipline, allows irregular intervals, which will cause the fire to become hurried, then the probability is that he will find himself without ammunition long before there is any chance of replenishing his store.

It is, however, the custom abroad when engaging artillery, to fire very rapidly immediately after finding the range; this is for the purpose of gaining the upperhand and preventing the enemy's ranging. A superiority having been established can be kept, and the intervals may gradually be increased until ordinary fire is resumed for the economy of ammunition. In a defensive action the reserves of ammunition being closer at hand a more rapid rate of fire may be made use of.

To ensure regularity of fire it is as well, in the training of a battery, to drill, for a short time, watch in hand, until all concerned have a thorough appreciation of the intervals that should be given, otherwise the time is certain to be over-estimated and the intervals curtailed to an extent which would be disastrous to economy of ammunition and most certainly to regularity of fire.

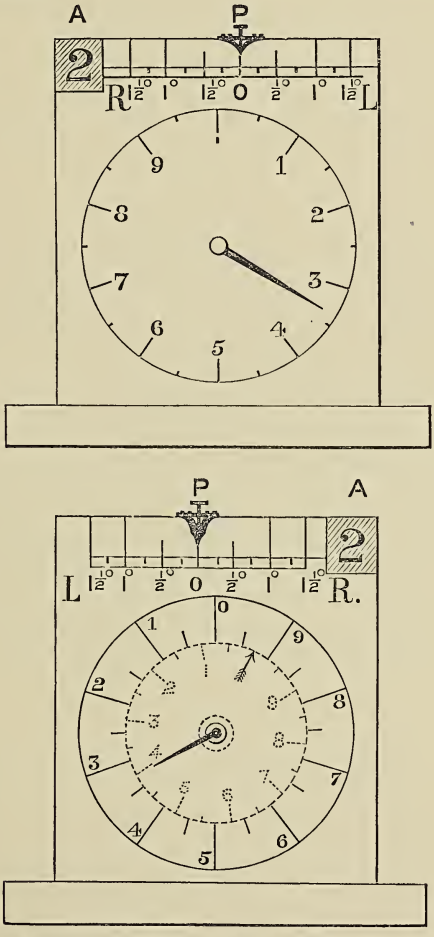
RANGE INDICATOR DIAL.

BY

LIEUTENANT F. E. FREETH, R.A.

I beg to submit a suggestion to further simplify the Range Indicator Dial given in Lieut.-Colonel Williams' paper in the December Number of the "Proceedings," (Vol. XIX., No. 2, p. 55.) viz. :—

To have a scale of deflection at the top (which might be graduated exactly as that on the deflection leaf of the gun) with the letters R and L as shown in drawing, with a metal pointer P working along the top surface of the board.



The corner A (it does not matter which right or left) cut out of the board and an angle slot cut to allow metal figure plates to rest in it for the thousands of yards.

NARRATIVE OF THE CRIMEAN SERVICES

OF

"I" TROOP, NOW "O" BATTERY, R.H.A.

BY

ASSISTANT SURGEON R. THORNTON.

CONTRIBUTED BY

COLONEL F. A. WHINYATES, *late* R.H.A.

AT the Annual General Meeting of the R.A. Institution in June last, the Chairman, in the course of his remarks, suggested that papers bearing on the history of the Regiment would be both suitable and acceptable for insertion in the "Proceedings." I think, therefore, the following account of the Crimean services of "I" Troop (now "O" Battery), R.H.A., by its Assistant Surgeon, which contains many interesting details often lost sight of in military histories, will be read with satisfaction by those who served in the campaign, as well as by the younger officers of the Regiment. To the Battery it must be a valuable record of an important episode in its career, especially as it bears tribute to its excellent conduct on all occasions. The MS. was given to Lieutenant W. Andrewes by Doctor Thornton when he left the troop, and he gave it to me some years ago. I have added some explanations as to individuals and some notes, but have left the narrative as far as possible in the exact words of the author, except where some slight alteration was needed, in order to make his meaning more clear.

REPORT OF "I" TROOP, ROYAL HORSE ARTILLERY,

From 1st April, 1854, to 31st March, 1855.

The period having now arrived for reporting the history of those committed to my care during the last year, a period crowded with momentous events, and which will go down the roll of history as one in which a great war with all its attendant evils was commenced, and an alliance, sealed in blood made with our gallant neighbours, the French, in the fields of Alma, Balaclava, and Inkerman.

Before entering on a detailed account of "I" Troop, Royal Horse Artillery, then Captain G. A. Maude's, now Major J. Brandling's, it will be necessary to take a rapid glance at the causes that led to its being sent abroad after a home service of nearly forty years.

This was the Troop known as the "Rocket Troop," commanded for so many years by the late Brigadier-General Strangways; who brought it out of action at Leipsic [1] (then the Russians were our allies, now our enemies). Since then, respected and beloved, he lived almost continuously with it until he fell gloriously at the battle of Inkerman. The history of both for that long period are bound together, and his old Troop had the last sad honour of bearing his corse to that hill-top grave overlooking Sevastopol, where he lies beside Sir Geo. Cathcart, and surrounded by many other brave and gallant souls that fell that day.

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[1] Doctor Thornton here falls into an error, common at this period. He confuses the services of the 1st and 2nd Rocket Troops. The 2nd, in which Strangways served as a Lieutenant, was present at the battles of Goerde, Leipsic and Waterloo, in the two former designated the Rocket Brigade.

Goerde or Görde was fought under the following circumstances:—A column of French troops of the 13th Corps, under General Pecheux, was pushed out from Hamburg, then held by Marshal Davoust, with the object of making a diversion in favour of a convoy of powder moving from Hanover to Magdeburg. In carrying this out, Pecheux was attacked by the Allies, under General Walmoden, between Dahlenburg and the Forest of Görde, on the 16th of September, 1813, was surrounded, and only got off with the loss of 1000 men in killed, wounded and prisoners. The French official account (Victoires et Conquêtes des Francais, Vol. XXII.) says, "The Congreve rockets, the effect of which was entirely novel to our soldiers, contributed to the disorder of this affair." General Pecheux fought with great courage against a force very superior to him in numbers.

At the battle of "All Nations," at Leipsic, between the Emperor Napoleon and the Allies on the 16th, 18th, and 19th of October, 1813, the Rocket Brigade was attached to the troops under Bernadotte, Crown Prince of Sweden. On the morning of the 18th, with an escort of cavalry it proceeded to the attack of the village of Poundsdorf, after a brief but hot contest, so great was the moral and material effect of the rockets, that the enemy fell into confusion and began to retire; when being pressed in pursuit, they surrendered to the number of between two and three thousand men. The Brigade then moved forward to attack the village of Sommerfeldt (Shonfeld) and was exposed to a very heavy fire of artillery and riflemen, a shot from one of whom shortly caused the death of the gallant Captain Bogue.* The command thus early in the battle devolved upon Lieut. Strangways, who at the close of the day received on the field the thanks of the Allied Sovereigns, the Emperor of Russia presenting him with his own Order of St. Anne. By Bernadotte, who had been an eye-witness of his gallantry throughout the campaign, he was afterwards presented with the Order of the Sword and a gold medal. In consequence of the signal services rendered by the Congreve rockets during the campaign of 1813, two Rocket Troops were formed in January, 1814, the 1st at home, the 2nd from the brigade abroad. In May, 1815, the Prince Regent directed that Leipsic should be worn on their appointments.

The 2nd Rocket Troop was engaged in several other affairs in 1813 besides Goerde and Leipsic. Mention is made of its services in Phillipon's "Memoirs and Campaigns of Charles John, Prince Royal of Sweden," where it is stated that at the siege of Wittenberg, in 1813, "exclusive of bombs, rockets were likewise used under the very able direction of the English Captain, Bogue."

The same work gives Bernadotte's bulletin concerning Goerde, in which he says, "The English Artillery and Rocket Corps deserve the highest encomiums." The record of the services of Lieut. Amherst Wright, who was a subaltern with this Troop in 1813, mention that he "served in the campaign of 1813–14 in Germany, under the orders of the Crown Prince of Sweden, and was present at the siege of Wittenberg, capture of Hanover and Lübeck, siege of Frederick Fort, and the siege and surrender of Glückstadt. He received a gold medal from the Crown Prince of Sweden for Glückstadt, and was made a Knight of the Royal Order of the Sword."

At Waterloo, this troop, armed both with rockets and 6-pr. guns, was in Picton's division, and posted on the left of the Charleroi road, near La Haye Saint, "a position." wrote Sir Augustus Frazer, "more than usually deadly," here it suffered numerous casualties, and among them Strangways and two other officers were severely wounded.† In the reductions consequent on the peace at the close of the war, this troop was reduced in July 1816. The first then became "The Rocket Troop," which Captain Strangways commanded from 1837 till 1846. In 1847 it became "I" Troop, and embarked on its first foreign service for Turkey in 1854.—*F.A.W.*

*From a letter to the family of Captain Bogue by Captain James, A.-D.-C. to Sir Charles Stewart, and an eye-witness of the events described.

† Among General Siborne's lately published "Waterloo Letters" is one from Capt. F. Warde describing the effective services of this Troop on the 18th of June.

Without entering into details, the present war may simply be stated to have been produced by the aggression of Russia, and the determination of France and England to prevent the annihilation of our ancient ally, the Turk.

The Russian armies occupied the Principalities of Wallachaia and Moldavia, and having taken possession of the various fortresses along the northern bank of the Danube, as a "material guarantee," the Sublime Porte declared war. Diplomacy dragged on its weary length, but at last the bloody tragedy of Sinope brought affairs to a climax. The Turks bravely resisted the attack, and checked their enemy's advance at Oltinitza, Turkukai, and other places; while, in the meantime, war was declared by France and England against Russia. Fleets were sent to the Baltic and Black Seas, and troops to Turkey; first to Gallipoli and then to Varna. Whilst these movements were proceeding the Russians laid siege of Silistria, on the hither side of the Danube, and after a month's bombardment, were obliged to raise the siege and retreat across the river, unable with their large force to capture a small mud battery held by 2000 or 3000 Arnauts. Why was this? Two young Britons undertook the preservation of this, the key of the position and of Turkey, and nobly fulfilled their promise. The names of Butler and Nasmyth will not be soon forgotten, the one died at his post, but not before he heard that the enemy were retreating, the other lives to wear his well earned honours. Whilst this great struggle was going on, on the termination of which such vast interests hung, the Allied armies occupied Varna, and portions of them were moved on the roads towards Silistria, as if for the relief of that place. Silistria being set free, a new order of tactics was decided on, which led to the armies coming to the Crimea, where, whilst disease still followed our steps, victory triumphantly spread her wings over our arms.

I was appointed to take medical charge of "I" Troop in March, 1854 (being previously attached to it for two years), on leaving Dublin for Woolwich, from whence we went to Turkey on the 24th of April, 1854. We were embarked in four sailing transports, the right division under Lieutenant Vandeleur,[1] in the "Sultana," No. 32, under the medical charge of Dr. Dwyer, 18th Royal Irish Regiment. The left division, under Lieut. Dashwood,[2] with Dr. Skelton in the "Rodsley," No. 37. The spare horses and men, under (2nd) Captain Barry,[3] with Dr. Llewellyn, 7th Dragoon Guards, in the "Rubicon," No. 38, and the centre division with Captain Maude,[4] Lieut. Whinyates,[5] and myself in the "Harkaway," No. 39. There was some delay in consequence of the crews being short-handed, but after a few days we were towed to the Downes, where we had to anchor, the wind being against us. We sailed from thence on the 27th of April. After entering the channel the wind continued dead against us, and in beating down we soon parted company. The "Sultana" and "Rodsley" put into Portsmouth

[1] Major A. Vandeleur died 6th June, 1860.
[2] Major H. W. T. Dashwood died 19th August, 1857.
[3] Major-General W. W. Barry, C.B.. died 19th April, 1883.
[4] Now Colonel Sir George Maude, K.C.B.
[5] Now Major-General F. T. Whinyates.

for two days, then proceeded on their way, made a good voyage, and arrived at Scutari in June, when men and horses were landed at Kulalie. The "Rubicon" beat steadily down channel and also arrived safely at Constantinople in June. The "Harkaway," after beating about for some days and not making any way, the Naval Agent decided on putting into Tor Bay, in doing so we struck on a wreck or rock off "Froward Point," [sic][1] this rendered it necessary to work the pumps to keep down the water, which we were making at about nine inches the hour. From Tor Bay we were ordered to Devonport to have the ship examined and any damage repaired. On arrival we were taken into Keyham Docks, when the injuries were quickly made good, and we again sailed on the 9th May. On the 13th, we were obliged to anchor in Peniche Bay, north of Lisbon, in consequence of the wind falling suddenly, and, a heavy swell setting in, although we had out two anchors, we were slowly drifting on shore, when providentially towards evening a land breeze set in, and we slipped anchor and got out to sea. During this dangerous period a Portuguese steamer passed within three miles of us, but took no notice of the guns of distress (75) that we fired. We reached Malta on the 30th May, and, having taken in water, sailed the same day and arrived in the Bosphorous on the 14th of June. We did not land but proceeded next day to Varna, here we disembarked on the 16th of June, 1854. The whole of the Troop re-assembled the following day, the 17th, when we marched from the landing place to the camp before Varna, and we encamped outside the town. Up to this period there had been very little sickness in the Troop, and the cases were of a mild character. I never received any returns of the sick on board the other ships, but any cases we had were few and trivial, and I shall take no further notice of them.

Having thus rapidly glanced at the causes that led to our coming to the Crimea, and slightly sketched our proceedings until the 16th of June, 1854, when we disembarked at Varna, I now continue the account of our wanderings, as I may call the marches through Bulgaria and in the Crimea.

Varna is situated on the north-western shore of the Black Sea, and towards the head of a small Bay which here indents the Bulgarian coast, being about three miles in length and the same breadth, affording a safe anchorage, except with N.E. winds. On the south the shore is precipitous, and on the headland a small mud fort protecting the entrance of the Bay, from this point the mountains stretch inland in a south-westerly direction, forming the lesser Balkan range, until they join the greater Balkan mountains near Shumla, thus forming a barrier against the hot winds of the South. After a short distance the hills gradually slope to the sea, and at the first point of divergence the cavalry and artillery were disembarked. The shore then makes a gentle curve to the northern side, and at this position a low, narrow sandy beach separates the Bay from the Devna Lakes. At the north-west point the town is situated, resting on both the Bay and the Lake,

[1] I have given the name as written, but I cannot find that such a place exists. Naval officers to whom I have referred at Plymouth consider the name was one in use among the local fishermen of that time.—*F.A.W.*

surrounded by fortification, of which the principal are directed inland. From the town to the northern extremity of the Bay the shore is flat for about a mile inland, when it rises abruptly and forms a range of low flat-topped mountains that extend to the north of Yeeni bazaar, short ridges pass southwards towards the lesser Balkans, and are separated from them by the upper and lower Devna Lakes. Varna is thus almost surrounded by high land. Passing along the northern shore of the lower lake, which is low and cultivated, we arrive at Aladyn, a small and beautiful valley, terminating at a small stream that connects the upper and lower lakes, having burst as it were through a cleft in the mountains. Here the mountains again diverge, and we see the upper lake, which is about five miles in length by three in breadth, whilst the lower one is about eight miles long by five broad. They are both fresh water, shallow, but navigable. The south shore of both lakes are high mountains covered with wood, and the scenery very beautiful from its park-like appearance, only wanting some signs of life to make it perfect. But no homestead breaks the solitude, and all, as far as man is concerned, is utter solitude. The northern shore of the upper lake is more marshy, and at its head there is an extensive swamp, which formed one of the boundaries of the camp at Devna, and must always, unless reclaimed, tend to the production of disease in its neighbourhood. We remained at Varna from the 16th to 26th of June, 1854, whence we marched to join the Light Cavalry Brigade at Devna. The encampment there was pleasantly situated in a small valley surrounded by an amphitheatre of hills, a short deep and rapid stream ran through its centre, on its banks and within one mile of its source were 13 mills. The village of Devna was situated on the side of one of the hills to the east, and, like all Turkish villages or towns, was extremely picturesque at a distance, but ruined and filthy when entered. The valleys were covered with barley, some few patches of wheat and oats, and the southern aspects of the mountains were covered with vineyards. Beyond the hills to the north were extensive plains, where large herds of cattle and flocks of sheep and goats roamed in search of a scanty herbage. The stream was very remarkable, its length was about three miles. Then it joined the upper lake, but appeared to spring at its full size from the earth, its head was a shallow pond about 20 yards in diameter, and the water could be seen rushing up through its sandy bottom, whence it flowed on, a stream of about six yards in width, and from four to five in depth. I found plenty of chub in it. After spending a month there we were moved to Yeeni bazaar, in consequence of cholera breaking out among the other troops. We marched with the Light Cavalry Brigade on the 26th of July, halting at Jasitipe that evening and arriving on the 27th July. The change was not beneficial to us, as we suffered from both cholera and fever there, arising principally from exposure to the sun and fatigue in obtaining water.

Yeeni bazaar is situated at the angle of that vast triangular plain which has the Danube for its base, behind us lay the mountains of the greater and lesser Balkans, in front a vast undulating arid plain, across which whirlwinds laden with dust were constantly sweeping,

about 12 miles off to the S.W. lay Shumla with its forts, and its great white hospital could be distinctly seen. The plain was deeply fissured in various directions through which the little rills flowed sluggishly on, in one was the village of Yeeni bazaar, above was our encampment, here we first felt the want of water, the horses had to go twice a-day nearly a mile to get a drink, whilst the men had to carry it up a steep hill, and this under a burning sun. In Turkey, fountains are numerous, yet the only one within half-a-mile of our camp, and that, too, only 50 yards from the Troop tents, we were not permitted to use for the first three weeks, as Lord Cardigan placed a guard over it, and retained it for his own use. However, the restriction was withdrawn afterwards, when one-third of the troops were in hospital. Much of the sickness at this place must undoubtedly be charged to the locality, but still, from its form and intensity I consider a great deal to have been produced by excessive exposure to the sun during the drills of from four to five hours, the time occupied in watering the horses by day, and heavy cold dews at night. All rejoiced when we left for Varna on the 25th of August, halting at Jasitipe that night, went on next day to Devna, where we halted for a day, and reached Varna on the 28th of August, from whence we embarked for the Crimea on the 30th of August, 1854.

Bulgaria is a rich field for the botanist, and would well repay any personal discomforts he might suffer in the varied treat spread out before him, the brushwood is principally composed of the Christ thorn (*paliurus Australis*), stunted oaks, the hazel, elm, ash, and a great variety of flowery shrubs, whilst the wild vine, clematis, bind them together. In the vineyards and orchards, which are very extensive, the cherry, plum, peach, almond-apple and pear trees are numerous, but there is very little of what may be called garden cultivation, onions, garlic, cucumbers, and melons being the vegetables principally met with. Fowls, ducks and geese were very plentiful. I saw very few wild animals or birds, but may name the eagle, vulture, hawks, crows, magpies, doves, larks and storks. Hares were occasionally seen, and numbers of ground squirrels. Serpents and lizards were numerous, while the croaking of the frogs was unceasing. I had neither means nor time for collecting specimens, as living under canvas, and a very limited transport, were complete bars to my taste in that way. However, I made a collection of seeds, both there and in the Crimea, which I sent to the Royal Botanical Gardens, Glasnevin, Dublin.

Previous to embarkation for the Crimea, the sick (of whom there were 25), and those who were not likely to be fit for immediate duty, were ordered to be left at Varna. I therefore sent 13 to the General Hospital, and the remainder accompanied their divisions. On the 30th of August the troop embarked in four ships. In transport No. 1, the "Pyrenees," Lieut. Vandaleur and the right division, with a portion of the 95th Regiment and their medical officer. No. 61, the "Harbinger," with Lieut. Dashwood and the left division, they had a strong infantry detachment, very crowded, much sickness on board, no medical officer at first, but one was obtained at Baltschick Bay. No. 85, the "Burmah,"

with spare horses and men and most of the sick, with Captain Shakespear[1] and Lieutenant Whinyates, both very ill with fever, no medical officer during the voyage, but Lieut.-Colonel Dickson,[2] R.A., was invaluable to the sick in attending and making up medicines for them. There was also a large detachment of infantry on board this ship, and in No. 40, the "Kenilworth," in which was the centre division, with Captain Maude and myself both ill, he suffering from chronic diarrhœa, and I from fever which I had contracted in Yeeni bazaar. So ill was I that Assistant Surgeon A. S. Fogo, R.A., was sent on board to look after me, he returned to his own battery on our arrival at Baltschick Bay, where fortunately the rest and change set me up, so that I was able to attend to the sick on board, but I did not recover my strength for some time after landing in the Crimea.

All the troops having embarked, we sailed from Varna on the 4th of September, and joined the *rendezvous* of the combined fleets at Baltschick Bay, when the whole sailed on the 7th for the Crimea, each steamer towing two sailing transports. The British were in six lines, the French on our right, and the Turks outside, whilst the men-of-war were stationed around us. It was one of the most magnificent sights that it is perhaps possible to conceive, there must have been some 300 vessels all moving steadily along. On the 10th of September the fleet anchored in the Black Sea, when I took the opportunity of visiting the other portions of the Troop, found in No. 1, one ill; in No. 61, nine sick; the same number in No. 85; in No. 40, there were only two sick. On the 14th, Gunner Hodgson died of cholera on board No. 61. The armies commenced landing this day near the Old Fort, north of Cape Loukoul, on a narrow strip of beach separating a large salt lake from the sea at Kalamita Bay; we were not opposed by the enemy on landing.

15th of September. The cavalry and artillery were landed this evening, last night was very wet and cold and the troops on shore were much exposed.

16th of September. In consequence of a heavy swell breaking on shore, the remainder of the troops could not land, two guns, with Lieutenant Vandaleur and the cavalry, made a reconnaissance in a northerly direction, but without seeing anything of the Russians.

17th of September. The remainder of the troops disembarked to-day, and the sick, 17 men, who were unfit to land, were sent on board the Kangaroo steamer, and Lieutenant Whinyates, being still too ill for duty, removed to another vessel. This was a great reduction of our strength, making 30 absent sick—that is, 13 at Varna, and now 17 sent to Scutari, of course throwing much extra duty on the remainder.

On the 18th of September we were still on the beach, and the disembarkation of the army completed: some of the divisions were sent southward in advance three or four miles.

19th of September. At daylight the Troop marched to join the army and take up our position, which we did at 8 a.m. We then advanced for a few miles, when the whole army was formed in proper

[1] Now Colonel J. D. Shakespear.

[2] Now General Sir Collingwood Dickson, V.C., G.C.B.

order of march. The French, about 25,000 men, on our right, with their right resting on the shore. The Turks in rear, about 10,000 strong, and the British on the left, our right resting on the French and on the left to the open country. Our strength being about 26,000 men.

The British were formed in two columns, thus:—

Cavalry.
"I" Troop, Royal Horse Artillery,
with some riflemen.

Light Division	Artillery	Second Division	Artillery
Guards and Highlanders	do.	Third do.	do.

Baggage.
Commissariat.
Fourth Division.
Cavalry.

In front and on our left skirmishers of cavalry and infantry were thrown out. We thus advanced across an extensive undulating plain, covered with a short parched and coarse grass, not a tree or shrub to be seen anywhere, having marched with occasional halts for about 10 miles, at 2.30 p.m. we reached the small stream of the Bulganac, where both men and horses enjoyed the water, being the first we had seen, for the day was both hot and bright. The cavalry having crossed the stream, we followed, but were ordered back, as it was the intention to halt on that side for the night. Up to this period, with the exception of a few Cossacks, nothing had been seen of the enemy, who set fire to the farms and villages as we advanced.

Immediately after re-crossing the bridge we were ordered to the front, as our cavalry vedettes and the Cossacks were firing at each other. Having crossed a low ridge, we saw on the opposite side of the valley, about a mile from us, a large body of about 5000 Russian cavalry, our skirmishers and cavalry retired very steadily, when the Russians brought down ten guns and opened fire, the two Troops, "C" and "I," Royal Horse Artillery, immediately came into action and, having disabled two of the enemy's guns, quickly silenced them. (The first shot was from "I" Troop, and disabled one of the guns, and "C" Troop disabled the other. Lord Raglan immediately sent a message—"Well done Captain Maude.") The affair did not continue more than half-an-hour, when the Russians retreated off the field.[1] Our loss on the occasion was five men wounded and five horses killed of the cavalry, the artillery were not injured. The Russian loss was 18 men killed, 35 wounded, and 32 horses killed. We halted on the ground that night.

20th September, 1854.—The Troop fell in at 7 a.m., the men having first had their breakfasts, but did not move till 10 a.m., when the

[1] Captain Willett of the 17th Lancers, writing to his brother on the 19th of September, 1854, thus speaks of this affair. "They (the Russians) then brought up their artillery. We brought up Maude's Troop, and your old Troop,* now commanded by John Brandling, Strange assisting him. Our practice was beautiful, the first shot from your old Troop went right into a gun, and the second into a regiment of cavalry in close column: the thing did not last half-an-hour."

* "C" Troop, R.H.A.

right of the French army was brought forward. It was a fine warm day with a gentle breeze, the same order was observed and we moved across a similar undulating plain to that we had passed yesterday. We saw at about six miles distant a range of hills, on which the enemy were said to be in force, we halted occasionally, and at 1 p.m. we were close enough to see large masses of the Russian troops on the heights, with formidable batteries along its face commanding the river which ran close to the foot of the hills through the narrow valley that separated us from them. The army was again ordered to halt and load, there was now no mistake that work was before us, from this moment until we halted on the heights of Alma there was scarcely a check, and in three hours we were in possession of a position that the Russians vainly hoped they could have held for three weeks. I am not going to describe the battle, but simply state the part the Troop played in the proceedings of the day. As soon as we came into the range of the heavy guns of the Russians, the infantry deployed into line and advanced, the cavalry, about 500 men, and "I" Troop, R.H.A., were posted on the left flank to protect it from attack, a large body of Cossacks manœuvring opposite to us. As soon as the enemy began to waver, the Cavalry and Troop crossed the valley and river, reached the top of the hill and opened fire on the retreating enemy, doing much damage, our losses during the day being one horse killed and one wounded. Having encamped on the ground lately occupied by the Russians, the army halted on the 21st and 22nd of September, collecting the wounded and burying the dead; the loss was fearful. The British lost nearly 2000 in killed and wounded, the French about 1800, and the Russian must have been about 10,000. Having no wounded of my own to look after, I spent my time in operating and dressing those lying on the field, but we were sadly in want of the means of transport—the ambulance having been left on board ship—this rendered the removal of the wounded both tedious and painful. On the 21st, cholera again visited our army, and many fell victims to it. On the 22nd one gunner died after 15 hours' illness, and several of the men complained of diarrhœa, with griping, which I checked with opium.

On the 23rd of September the army marched to the Katschka across a similar plain, when, on reaching the river, the army halted for the night, but "I" Troop and cavalry were sent forward on a reconnaissance to Duvankoi, where we halted for a few hours in a narrow gorge, and then retreated by the narrow road up the face of the mountain. We saw a large force of cavalry who retreated from the villages as we approached. The inhabitants brought in large quantities of grapes, peaches and bread, which they were much astonished at receiving payment for, they must also have been agreeably surprised at our not plundering their houses, for as the Cossacks retreated they generally left only a wreck behind. It was midnight before the whole troop had re-assembled on the top of the hill. Next day, which was very hot, we suffered severely from thirst, as we had no water until we reached the Belbec river about 3 p.m. that evening, men and horses being nearly 36 hours without it. On the 24th of September the army halted on the heights of the Belbec. We now came into a densely wooded country.

On the 25th of September the army made the flank march on Balaclava. As usual, the troops were under arms at daybreak and commenced the march about 7 a.m. After advancing for about a mile the road divided, one (the post road) leading directly south to Sebastopol, the other (a bye-road) easterly along the heights to Khutor, Mackenzie, and Simpheropol. The cavalry had gone on in advance on the eastern road, where we followed them, the ground almost impassable on either side from the thick brushwood and trees. Here we first found three arabas blocking up the road, one loaded with dried fish, and the others with iron, they were removed with some trouble, and in a short time we overtook the rear-guard of the cavalry, who had gone off to the right on a wood-cutter's road quite impassable for artillery. Here Captain Maude halted and sent back Lieutenant Vandaleur for orders or support, as the cavalry were so broken up in the brushwood, that if attacked they would have been completely at the mercy of their assailants. General Durand of the French Staff told Captain Maude that they had gone the wrong way, this caused the delay of an hour, when Lord Raglan came up and ordered an advance, we then continued the road for about four miles through a dense oak wood, saw nothing of the cavalry or infantry until we were within a few hundred yards of Mackenzie's farm, here through an opening in the trees we saw the advance-guard of the cavalry, on advancing a little further we came to an open field across which we saw the Russians passing with wagons, being still concealed, we halted and brought forward two guns but did not show ourselves. Orders were sent back (I was sent) for the cavalry to advance, for now we were in front of them. Lord Raglan, who was in advance, sent forward his escort to see what force there was, they immediately returned stating that the Russians were in force and retreating. The Troop advanced suddenly across the open field, and came into action within 20 yards of a Russian regiment who were drawn up across the road, where it again entered the wood, they fired a volley and immediately broke and disappeared in the wood, the artillery followed them with canister and shrapnel. The cavalry now came up and the pursuit was continued for about half-a-mile, a large quantity of baggage, ammunition and flour fell into our hands, and some prisoners were taken, and several dead were seen in the wood; in fact, we had come upon the rear-guard of the Russian army who were retiring on Simpheropol. After a halt of some hours we continued our march and descended into the valley of the Tchernaya, which river we crossed and encamped for the night. Next day, the 26th of September, we marched on Balaclava, this time the Troop and cavalry formed the rear-guard. "C" Troop, R.H.A., was engaged in the capture of the place, and all enjoyed the rest after the short march.

Balaclava now became the base of our operations, and was to us of great importance on account of its harbour, which, though small, is a safe anchorage, protected on both sides by the high and precipitous mountains which prevail in this portion of the Crimea, and are principally composed of porphyritic lime-stone. At the mouth of the harbour are the remains of an ancient Genoese fort, round which the entrance to the anchorage curves at almost a right angle, and this

adds to its security, rendering it completely land-locked. Outside the shore is one continuous cliff varying from 200 to 800 feet. At the head of the Bay the hills slightly diverge and form a narrow valley, that is terminated by a small hillock round which the village of Kadikoi was built, this valley on our arrival was a charming spot, studded with farm-houses, vineyards, and orchards teeming with fruit, now the blight of war has passed over it, scarcely a blade of grass remains to tell what it once was. The south-western range of mountains extends along the shore towards Baidar, whilst those on the northern side form the plateau on which the Allied armies have encamped, and taken up their position before Sebastopol, including within our lines the valley of Karani, the Monastery of St. George and Kamiesh Bay.

27th of September.—The principal portion of the army marched to the heights above Sebastopol, the Cavalry and Troop being in advance, saw only a few Cossacks, and had a good view of the city, took possession of the heights undisturbed by the enemy, and we now technically "sat down before it." The Troop was ordered to take possession of a gentleman's house and protect it from destruction, but as usual the Cossacks in their retreat left us little to protect, furniture all destroyed, beds and everything that had the slighest stuffing ripped open and the contents strewn on the floors. I have never seen such a complete wreck of what must have been a luxurious, if not a happy home, the house was surrounded by vineyards. It afterwards was the residence of Lord Raglan, we were left there in peace and quiet until the 3rd of October, when we marched back to Balaclava and joined the Cavalry Division, we encamped in an old redoubt over Kadikoi, where we remained until the 26th of October, when we accompanied the Cavalry to the camp within the lines on the Sebastopol heights, and our place was taken by a Field Battery (Barker's), the redoubt re-made and armed with heavy guns.

During the interval, the Troop and Cavalry were before daylight every morning under arms in the plain, and generally returned to camp about 7.30 o'clock. The Balaclava plain, which is an expansion of the valley already mentioned, is of a quadrilateral shape, bounded on the east by the range of mountains on which the village of Kamara is placed, on the north by the range of hills, the Fedukhine hills on the south bank of the river Tchernaya, the west by the precipitous face of the high ground or steppe forming the heights of Sebastopol, and on the south by the continuation of that range to Balaclava, or rather to Kadikoi. It is intersected through the centre by a low range of hills, having five or six conical points on which earthworks were thrown up, and the Turks placed in them being the advanced line of defences for the protection of Balaclava, the second line being from the sea on the east of the town along the range of heights by Kadikoi round to Inkerman, where the siege works commenced, thus enclosing the whole of the Chersonese Cape in the hands of the Allies.

7th of October.—The Russians made a strong reconnaissance this morning and crossed the Tchernaya range, we had a shot at them but they were too far to receive any damage from us.

18th of October.—The Russians again made a demonstration in force but did not attack, a few rounds from the Turkish redoubts forced them to withdraw out of range. We notice that the papers cry down the Russian troops too much, and it is very painful to have them writing so flippantly at home about the war, that the troops should do this and that whilst they are sitting comfortably at their firesides, whilst many, very many of us had not seen a bed or changed their clothes since their arrival in the Crimea. On the 17th of October the bombardment of Sebastopol commenced at 6 a.m., with regard to it the Troop had little to do, except that our horses were daily kept hard worked dragging up guns, mortars, and ammunition to the front for the siege.

On the morning of the 25th of October, the troops as usual stood to their arms, there was a dense fog over the plain, and at 6.30 o'clock as they were returning to camp, a gun from one of the Turkish redoubts gave notice of the proximity and advance of the Russians, in consequence of the fog we could not for some time discover in what force they were, but they immediately returned the fire of the redoubts, and a terrific cannonade commenced. The Horse Artillery and Cavalry advanced to the ridge, and the artillery between redoubts Nos. 3 and 4 immediately came into action with the Russians, who must have had with them thirty pieces of artillery, many of heavy calibre, they quickly silenced the Turks in the principal redoubt, No. 5, and advanced to capture it, the Turks retreating before them—indeed, the small handful who were in it could not possibly have held it unsupported as they were. In the meantime, Captain Maude's horse was struck by a shell in the chest, which, bursting, killed the horse and wounded him, a large splinter cutting him on the left leg above the patella, dividing the muscles to the bone, and also tore a piece of flesh out of his left forearm, lacerating the radial artery, he also received some contusions on the face about the eyes. I had him borne off the field, but it was nearly half-an-hour before I could do anything for him, as when I had him first brought under the brow of the hill to avoid the Russian fire, we had again immediately to retire, as the Cavalry and Artillery were retreating on the line to Sebastopol, thus drawing on the Russians who were now in possession of two of the Turkish redoubts, leaving us nearly midway between both. I had to hurry on the bearers and obtain fresh assistance, and we moved as rapidly as possible off the field to Kadikoi, but not before he had lost much blood was I able to place a ligature on the artery and dress his other wounds. He was then carried on board a ship, and thus we lost the presence and valuable assistance of our Commanding Officer, and one in whom even the whole army placed the greatest confidence. He was a sad and serious loss to us, but still I hope to see him once more with the army filling some more extended sphere for which he is so remarkably fitted. To return to the Troop, Maude being wounded, Lieutenant Dashwood assumed the command and found they were reduced to seven rounds of ammunition, which he reported to Lord Lucan, who ordered him to retire, but during the short interval he had his horse shot under him, and having mounted a troop horse, it was almost instantly wounded. We had now lost Captain Maude, wounded; Gunner McBride, killed by a

round shot through the chest, and eleven horses killed and wounded. Whilst retreating out of fire, Captain Shakespear, who had been on duty elsewhere, arrived and took the command for the remainder of the day. As our Troop and Cavalry retired, the Russian cavalry advanced into the plain in two bodies of about 3000 men, one portion sweeping down on Kadikoi advanced against the 93rd Highlanders and Turks. The Turks fired a volley and bolted to the rear of our troops into the town, and commenced pillaging everything, even our tents, whilst the 93rd waited quietly until the enemy arrived within 200 yards of them, and poured in a withering volley. However, they still advanced, encouraged by the flight of the Turks, and then the Highlanders gave them another volley, which completely broke them, and they retired torn up by the fire of Barker's Battery and those on the heights. At the same time the other portion of the Russian cavalry (Blue Hussars) advanced against our Cavalry, when the Greys and Inniskillings, supported by the 4th and 5th Dragoon Guards, made their magnificent charge, and turning round again, charged through them, thus completely routing the enemy. They must have been 10 to 1 of our Cavalry.[1] From this period the Russians commenced retiring, and additional troops were coming up to our assistance. The Russians had been busy removing some guns from the redoubts abandoned by the Turks, our infantry regained two of them by the bayonet, but we had to leave the others in the hands of the enemy. All would thus have ended well, were it not that now took place, that unfortunate charge of the Light Cavalry, in which, well and nobly as it was made, they left 400 of their companions dead behind them. The Troop had been ordered to accompany the charge, but Captain Shakespear, finding that his light guns would be unserviceable long before they could be brought within range, halted, soon after the Light Brigade returned, and mustered but 156 out of 600 that had made the charge: this ended the battle of Balaclava. I leave it to Lords Lucan and Cardigan to settle between them on whom the blame rests.

26th of October.—Moved the sick and stores of troop to the heights of Sebastopol, but the Troop continued in the plain with the Cavalry, a few days after the whole were brought within the lines, the weather now became cold, damp, and very trying to the feelings, as we were all in great want of warm clothing.

5th of November.—At daybreak, which was hazy with a heavy mist, the Russians made a demonstration against Balaclava, and we got under arms; soon after we heard heavy firing in front, which was the commencement of the battle of Inkerman. The Troop was not actually engaged, as it was watching the Russian force that threatened but did not advance on Balaclava. I therefore went to the front to assist the wounded, and returned to my tent after a severe day's work, both in operating myself and assisting others. Of the many cases of that day, the only one connected in any way with the Troop was the death of Brigadier-General Strangways, killed by a round shot, we buried him next evening. On the 7th I was again engaged operating, and this

[1] Dr. Thornton may not have witnessed this part of the battle, being with Captain Maude, which accounts for some of his details being incorrect.—*F.A.W.*

time on the Russians, for all the English had been attended to on the night of the battle. I may here refer to the great outcry against our not using chloroform. This is a mistake for, when we can, we do so, but people at home forget that we have neither the conveniences, time, nor assistance requisite for its safe administration always at hand. It is absolutely necessary that it should be given by a medical man, and he has quite enough to do to watch its effects to be of the slightest assistance to any other portion of an operation. Then how seldom can two doctors be available to assist each other. I have had to amputate a leg and arm on the field of Alma with only the assistance of my servant, and almost all the other surgeons have occasionally been in the same predicament at one time or another. No, we can only make the best of circumstances as they arise, and avail ourselves of that boon to humanity whenever possible. But rules in such cases are ridiculous, and show merely ignorance in those who propound them. Too many such, in the shape of "advice," have we already seen in the newspapers from self-satisfied wiseacres.

On the 14th of November the camp was visited by a severe hurricane, which levelled tents, destroying almost everything, and adding deeply to the misery, cold, and hunger from which we were previously suffering, the sick were exposed to the weather, and, besides all this, there was a fearful loss of life and property in the Bay. The wreck of the "Prince" and other vessels on that occasion tended materially to our discomforts by the loss of provisions and warm clothing, which would have been welcome after existing in the wet, mud, and exposure of the camp.

On the 5th of December we were marched nearer to Balaclava and encamped in Turkoman Valley in a spot well protected from the cold winds, here we made preparations for wintering by hutting the horses that were rapidly dying from cold, starvation, and overwork. We were occupied chiefly in dragging guns and ammunition to the front through the dense mud on the quasi roads.

On the 20th of December there was a reconnaissance towards Kamara, but only a slight exchange of shots with the skirmishers. We now had a fortnight of very delicious weather, in fact a second summer, warm clothing was now issued to both officers and men.

The first hut that we received was erected on the 11th of January, 1855, and of course employed for the hospital, it was then sadly required, for a marquee is a miserable place for sick in the cold or wet weather, and I always had an average of 25 sick in one. It was almost an impossibility that the sick could recover in such a position. From this period the health of the Troop began to mend, by degrees all the men were hutted, but the officers were under canvas all the winter, from which we occasionally suffered severely.

Nothing of importance occurred during the remainder of the period I remained with the troop, except the changes of the officers arising from promotion. The officers leaving England were—

Captain G. A. Maude, Commanding, Brevet-Major and C.B. (Wounded), after Brigade-Major, Woolwich.

2nd Captain J. D. Shakespear, who joined at Varna a Brevet-Major.

Lieut. A. Vandeleur, promoted 2nd Captain.
" H. W. J. Dashwood, promoted 2nd Captain.
" F. T. Whinyates, returned home with the Troop.
Assistant-Surgeon R. Thornton, promoted Surgeon 9th Foot.

In October, 1854, Capt. Maude was wounded, 2nd Capt. Shakespear assumed the command, which he retained till promoted in January, 1855, when Maude was relieved by Major Brandling,[1] who had held temporary command of "C" Troop during the previous portion of the campaign, and Shakespear, by Major Tupper[2] as 2nd Captain. Lieut. Vandeleur promoted 2nd Captain October, 1854, was relieved by Lieut. Andrewes.[3] Lieut. Dashwood promoted 2nd Captain January, 1855, was relieved by Lieut. Dames,[4] and Assistant-Surgeon Thornton[5] promoted Surgeon 9th Regiment in April, 1855, was relieved by Assistant-Surgeon A. S. Fogo,[6] M.D.

The strength of the troop varied much during this period, and was increased in consequence of the alteration in the army and equipment of the Horse Artillery. Hitherto the Troop had four 6-pr. guns and two 12-pr. howitzers with a 6-pr. rocket carriage. It being decided that heavier metal should be brought into the field to enable us to meet the Russians on equal terms, the armament was changed to four 9-pr. guns and two 24-pr. howitzers and the 6-pr. rocket carriage. This required a greater number of horses for the increased weight, and more men are necessary for the working of the guns. However, the increase is not sufficient for the practical efficiency of the Troop, for taking the average proportion of sick (for which no allowance has been made) during the past year at 12 per cent., which is rather under the mark, it is quite evident that the Troop at its present strength must be always short-handed; indeed, during the summer of 1854 the sick often exceeded 25 per cent., and on service a large sick list must be always calculated on. An extra amount of duty is thus thrown on the remainder, and this has had a very material influence in keeping up a large sick list and deteriorating the health of the whole.

The following is a return of the strength of "I" Troop, R.H.A., from 1st of April, 1854, to 31st March, 1855:—

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[1] Lieut.-Colonel John Brandling, C.B., died 16th April, 1860.

[2] Now Lieut.-General G. Le M. Tupper.

[3] Now Colonel W. G. Andrewes.

[4] Now Captain T. Longworth Dames.

[5] Deputy-Surgeon-General R. Thornton, died 16th December, 1884.

[6] Now Deputy-Surgeon-General A. S. Fogo, M.D.

Increase and Decrease in Strength.	1st Captain.	2nd Captain.	Subaltern.	Assist. Surgeon.	N.C.Os & men.	Total.	Horses.	Remarks.
Strength 1st April, 1854 ...	1	1	3	1	185	191	180	Woolwich.
Addition on promotion ...	1	1	2	—	6	10	—	Crimea.
Drafts 1st September, 1854	—	—	—	—	6	6	12	"
" 2nd November, "	—	—	—	—	16	16	5	"
" 3rd December, "	—	—	—	—	32	32	17	"
" 4th February, 1855	—	—	—	—	21	21	77	"
Transferred...	—	—	—	—	10	10	26	"
Totals	2	2	5	1	276	286	317	
Removed on promotion ...	—	1	2	—	4	7	—	
Died in Regimtl. Hospital	—	—	—	—	12	12	—	
" General "	—	—	—	—	10	10	—	Scutari, Varna, Balaclava, Abydos.
Killed in action	—	—	—	—	1	1	10	
Missing	—	—	—	—	5	5	—	Sent to General Hospital supposed to have died.
Invalided to England ...	1	—	—	—	14	15	—	
Sent to England (not sick)	—	—	—	—	3	3	—	Servants.
Died of disease or debility	—	—	—	—	—	—	115	
Total to be deducted	1	1	2	—	49	53	125	
Total strength 31st March, 1855	1	1	3	1	227	233	192	

During the same period the sick from all causes were 529, and were thus disposed of:—

Discharged to General Hospitals	58
" Duty	433
Died	22
Remaining Sick 31st March	16
	529

Of those sent to General Hospitals :—

Rejoined	23
Sent to England	14
Died	10
Missing, supposed to be dead...	5
Remaining	6
	58

The deaths and missing to diseases sent to General Hospitals being 27·62 per cent., whilst the deaths with the regiment were 2·54 per cent. The total casualties being—

Died in General Hospitals	10
,, Regimental Hospitals	12
Killed in action	1
Missing	5
	28—or 5·48 per cent.

of the total sick and 13·18 per cent, of the average strength.

The climate of the southern coasts of the Crimea may be thus described, it has no real autumn, but a double spring. January is generally a mild month, and towards the end of February the cold sets in and continues till April, sometimes the thermometer sinks to 20° to 30° below freezing point. May, June, and July the weather is pleasant, mild, and the atmosphere cooled by occasional heavy showers, in August and September the weather is generally very warm and dry. October mild weather, November and a portion of December wet, cold and heavy rains set in, when what may be called the second summer commences and continues for about three weeks or into January. Altogether the climate may be considered as remarkably mild, and if we had been placed in other circumstances than living only under canvas and with only summer clothing during the most trying portion of the year, it might have proved far from unhealthy, and well adapted to the constitution of the British soldier.

GENERAL.

Return of Diseases. Nos. 2 and 3.

The following is a return of the diseases from 1st of April, 1854, to 31st March, 1855 (No. 2) :—

The diseases may be again classified for more practical description, according to the arrangement of the weekly returns, and exhibit at the same time the situation and admissions each month (No. 3).

Fever.—The first class of disease that comes under notice is that of fever, the cases were very numerous, the total being 140, of which 104 were quotidian intermittents, and 3 tertians, 31 continued fevers, and 2 well marked and very severe cases of remittent fever. Of the total, 130 were discharged, 6 proved fatal, and 4 remained under treatment. Several of the intermittents had a tendency to pass into the remittent type, especially in Bulgaria, but in general they were of a mild character. Convalescence was very slow, in consequence of exposure to the weather, or bad accommodation for the sick. The continued fevers were not so numerous, but from the same causes were also generally slow in recovering. The principal amount of disease was in August, when 55 were admitted, the Troop was then stationed at Yeeni bazaar, the causes that tended to produce this state I have previously described. The agues were well marked, and the disease yielded to the influence of quinine exhibited in large doses immediately on the solution of the

paroxysms. Where the fevers were complicated with irritability of the bowels, as was frequently the case, the exhibition of quinine, combined with Dover's powder and Hydrarg. c. cretâ, was very successful.

Diseases of the head and nervous system were very limited in number and class, one case of coup de soleil, which was relieved by blisters to the occiput, one of fainting also from heat, two cases of epilepsy, in one case hereditary, the origin of the other was doubtful, both however were developed by exposure to the sun, and one case of tympanitis was slight, readily yielding to counter irritation.

Diseases of the lungs, considering the circumstances under which the Troop was placed, the exposure to wet and cold, diseases of this class were remarkably few, and in general only cases of simple bronchitis, the four cases of pneumonia were, however, very severe, and required very active treatment, the case that proved fatal was whilst the troop was encamped on the heights of Sebastopol during the latter portion of November, 1854, when the men were much exposed to wet and cold, and the camp was one sheet of deep mud, the inside of the tents and hospital marquee being not much better.

Disease of the liver and spleen.—One was a case of acute hepatitis, the remainder were of jaundice, produced in the same way by cold, wet, and rapid variations of the temperature, they were generally rather tedious in recovering.

Disease of stomach and bowels.—This class of disease exceeded even the average strength of troop in number, and had a serious influence in reducing the strength, both of the men and numbers of the Troop. Climate, exposure to the sun by day and cold dews at night, improper food, want of vegetables, bad cooking, and the impossibility during the earlier stages of the campaign of remedying these defects, tended much to prolong the disease and retard convalescence. Of diarrhœa, there were 145 cases; of acute dysentry, 51, and three other slight cases. Bowel complaints prevailed most at Devna in July, and in October and November at Balaclava, they appeared to decrease as fevers increased, and *vice versâ*, in the earlier months the hot weather, and in the latter the green and unripe grapes and fruits tended to this state; the treatment I found most successful was a combination of Dover's powder, Hydrarg. c. cretâ, and aromatic confection.

Cholera first visited us in Yeeni bazaar, when both cases proved fatal, it still followed us across the Black Sea, when one patient died, and on the march, when it proved very fatal, the total number of cases was 24, of whom 16 were discharged and 8 died, being a mortality of one-third of the cases. There were numerous cases of diarrhœa accompanied with severe choleraic spasms, which recovered, are not included in these. The most successful treatment I found to be the administration of mustard emetics, followed by calomel and opium in small and frequent dozes, the strength being kept up by arrow-root and brandy, and also the free use of sinapisms. I have never experienced any ill effects from allowing the patients to drink freely of cold water; indeed, I rather think it beneficial, as it serves to allay the intense and painful thirst that accompanies this disease.

Rheumatic affections were slight and unimportant.

Venereal complaints.—These cases were in men who arrived in drafts from England, one of stricture was severe..

Phlegmon and abscess were numerous, but more troublesome than important. There was one case of frost-bite of the fingers which occurred during a reconnaissance in February, 1855; he did well, but it was some time ere he recovered the use of his fingers.

Wounds and other mechanical injuries were numerous and some were severe; there were eight cases of sprains, principally of the ankle, but one case of gunshot wound, that was in Captain Maude, who, at the battle of Balaclava on the morning of the 25th of October, 1854, was wounded by the bursting of a shell in the chest of his horse. A splinter struck him on the left leg, making a deep incised wound to the bone, about two inches above the patella, completely dividing the vasti muscles, in the left arm it tore away the muscles and lacerated the radial artery, from which he had severe hœmorrhage, his left hand was also lacerated, and he also received some contusions on his brows, by which he has since lost the vision of one of his eyes. Having put ligatures on both ends of the artery and dressed his other wounds, he was put on board a ship and sent next day to Scutari, from whence he returned to England.

One man, Gunner McBride, was killed on the same day, immediately after, by a round shot through his chest.

There were a great number of contusions, principally on the thighs and groins, by kicks from horses.

Morbi Oculorum.—There were only six cases, all arising from the effects of the fine dust getting beneath the palpebræ and irritating the conjuntiva.

Other Diseases.—Of the total of 30, there were 5 of erysipelas, principally of the legs, and 15 cases of scurvy occurred in December, 1854, during which period the troop was much exposed to the inclement weather, and were principally on salt provisions, without any vegetables. With the free use of lime-juice they rapidly improved.

On the whole, the troop may be considered to have been comparatively healthy, and it was always in an efficient state for the field. Our Commissariat was remarkably well supplied, except during the month of November, but that arose from causes over which our Commissary, Mr. de Gernon,[1] of the Irish Constabulary, had no control; if untiring zeal and energy could effect anything, it was always exerted on our behalf by him, and whether on the march or in camp our supplies never fell short.

The conduct of the men, both in camp and before the enemy, was most exemplary, and if my labours at times were most severe, I always loook back with pleasure to the ready and willing assistance I received from all for carrying out my views.

(Signed) R. THORNTON.

CRIMEA,
16th October, 1855.

[1] Mr. Christopher de Gernon was appointed a Resident Magistrate in Ireland in 1860, and was accidentally drowned in 1875.

APR 1 1893
U.S. PATENT OFFICE

SOME NOTES

ON

APPLIED FIELD FORTIFICATION.

BY

LIEUT.-COLONEL E. CLAYTON, R.A.

THE writer, whilst a Professor at the Staff College, found certain difficulties continually arising in the application to actual ground of the theoretical principles of Field Fortification. The following pages are an attempt to diminish these difficulties by, as far as possible, anticipating them, discussing them, and suggesting various solutions from which choice may be made as occasion requires.

SELECTION OF POSITION.

Selection of Position.

It is not proposed to enter into a discussion on the strategic conditions which may dictate the occupation of a defensive position, but simply taking for granted that circumstances demand it, to indicate the reasons which would influence a commander in choosing the actual ground he should occupy.

The reason which will outweigh all others will be that it will serve the object he has in view. After that come the conditions that it should have as clear a field of view and fire as possible, and that it should bear some sort of proportion to his force. But this proportion will vary within very wide limits. The Battle of the Lisaine, in January, 1871, shows how a General may be obliged to defend a position quite out of ordinary proportion to his force. General von Werder, to protect the siege of Belfort, had to guard a space of some 22 miles with only 37,000 infantry, or barely $1\frac{1}{2}$ men to a yard.

But it may be desirable to have some sort of normal proportion as a guide. Until actual experience with the most recent developments of arms and explosives is obtained, some sort of guide may perhaps be found in a consideration of the strength of occupation of the German lines of investment round Metz in 1870, as given by Paulus in his work, "Die Cernirung von Metz."[1] From the data given by him we find that in the first days of the investment, before any works of fortification had been carried out, 14,800 paces out of the 54,900 embraced in the whole line were watched only by cavalry, and the remaining 40,100 paces were occupied by 145,700 infantry, about 12,000 cavalry and 622 guns, giving an average of 3·6 infantry per pace, with a proportion for every 1000 infantry of 82 cavalry and 4·25 guns. From the middle

[1] Paulus. Cernirung von Metz. Appendix p. 125, sqq.

to the end of October, however, when the line had been strengthened by fortification, we find the average strength of infantry reduced to 2·5 men per pace, with 90 cavalry and 4·7 guns per 1000 infantry, the proportion of infantry being very considerably reduced, while that of the two other arms is slightly increased as compared with the infantry. From these figures we may perhaps draw the deduction that in an average European country the front of an extensive position may be adequately defended by $3\frac{1}{2}$ infantry per pace, with the usual proportion of cavalry and guns if no works of fortification have been carried out, or by $2\frac{1}{2}$ infantry per pace if the position has been artificially strengthened. This would provide for the, generally speaking, passive defence of the front, including local counter-attacks and local reserves, but would not include such forces as might be considered necessary for decisive offensive action and for the protection of flanks not naturally strong.

Protection of Flanks.

Protection of flanks.—A General, recognising that an enemy will have strong inducements to operate on the flanks of his position, will first try to extend his line sufficiently to rest them on natural obstacles or to make it dangerous to try and outflank them. If he cannot do this without weakening his line more than he thinks safe, the flanks must be protected in some other way. Probably the best way to protect an exposed flank is by posting a body of troops in echelon in rear of it, so as in turn to take in flank an attack directed on the flank of the main line, or necessitate a dislocation of the enemy's force if he attempts by a still wider movement to get round the refused force itself. If possible, however, the existence of this refused echelon should be concealed from the enemy's knowledge during the early stages of the action." [1]

Strong localities on the flank of the main line would also be of great value, for they ought so to check the flank attack as to give the refused echelon and the reserves time and opportunity to act on the flank or even the rear of the attacking force with most decisive results.

If, then, a refused echelon is the best way of protecting an otherwise exposed flank, a General, if he finds no practicable extension, will bring his flanks to positions of natural safety and will be influenced towards somewhat restricting the front occupied by his main line, so as to have more troops available for protecting the flanks he ultimately decides on. So that at first, in making his plan, the General will try if he can stretch his force to safe flanks, but if he finds he cannot do so, will draw in his front till he can spare from his main line fully sufficient force to meet the flank attacks from which he cannot escape.

Distribution of Troops.

The General, having decided on the front to be occupied and the amount of his force he shall keep in rear of his flanks and in reserve, will then assign certain portions of the position to his different units. For instance, suppose he has five Army Corps and that one flank of the position is so strong naturally or strategically as to be practically safe from a serious turning movement, he might keep one corps in reserve, place another corps in echelon behind the exposed flank, and divide the front of the main position between the three other corps.

[1] See remarks on masking advanced position, p. 363.

This may seem a large proportion removed from the front of the position, but remembering what Von der Golz says:[1] "A General may quite well find himself obliged to place a still smaller proportion of his force in the ostensible position and keep an actual majority of the army in hand to meet the turning operations of the attack and strike offensive blows."

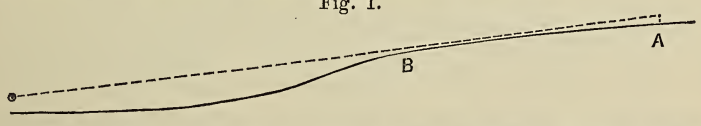
As regards the arrangement of the corps in the sections allotted to them, the Commander-in-Chief of a large army will probably only give the most general indications, such as whether the general line is to run at the foot of a slope, along the *crête militaire*, or in a retired position on a plateau and leave the more detailed arrangements to his subordinates.

Selection of Main Line of Defence.

With regard to the general line of defence to be taken up, the following remarks may be made. Setting aside particular cases, such as the defence of an important river or mountain warfare, positions may be either on a level plain or in an undulating country. In the case of a plain the shape of the ground will obviously not influence the decision about the line to be occupied, but that line will be chosen that gives the greatest amount of open ground in front and offers the most favourable localities as points of support, especially on the flanks. But in an undulating country there will usually be the choice broadly between three situations, viz., at the foot of a slope, on the *crête militaire*, or at a retired position on a plateau, at a greater or less distance from its edge. Which of these positions is to be occupied will usually be decided by the Commander-in-Chief. The selection is not always so easy as might be expected. It is pretty generally acknowledged that where the ground offers long, open, gentle, glacis-like slopes, the best position is on the crest of the rise. Open fields that can be effectively swept by grazing fire, facility for observing the country over which the enemy must advance and usually cover for reserves are secured by such a position, of which the ground about St. Privat on the field of Gravelotte is a notable example. But it is comparatively rarely that such a conformation of ground presents itself. In probably a majority of cases breaks in the evenness of the slopes will present themselves. In some cases the slopes, although gentle, will be convex in section, so that while their upper parts may be swept by the fire from a line on the highest part of the slope, yet towards their lower portions there will be dead ground where the enemy may find cover, as in fig. 1.

Gentle convex Slopes.

Fig. 1.



This will be found to be a very common case. The question will arise, should the line be placed at A or at B. In the first case the supports can be easily covered by the shape of the ground and can reinforce the fighting line comparatively unmolested. For although no doubt the falling trajectory of the enemy's bullets may to some extent

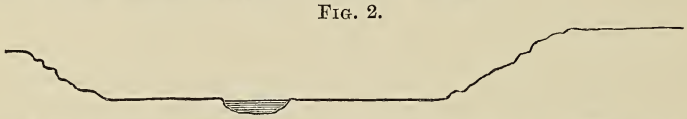
[1] Von der Golz. La Nation Armée, p. 340.

sweep the rear slope of the hill if they miss the main line, yet the supports will be hidden from *view*, so that their movements will be unknown, and no aimed or intensified fire can be directed on them while reinforcing the fighting line. On the other hand, there will be dead ground in advance of B. If, as the other alternative, B be chosen for the main line, the supports must move up in full view of the enemy while aimed and intense fire can be brought on them from the magazine rifles of the assailants as they move up. The data upon which would rest the decision which line to occupy would be these :— first the distance from A to B, and next the amount of dead ground in front of B, and whether flanking fire can be easily brought to bear on it. If the distance from A to B were not more than from 200 to 250 yards, while there was a considerable amount of dead ground in front of B, undoubtedly the forward position should be held, for the amount of space the supports would have to cross under fire is so small that the enemy would hardly have time to observe the movement and concentrate much fire upon it before it was over; whereas, if the rear position were occupied, the enemy could get with comparative ease so near the position as to be able to take advantage of any favourable circumstance, such as momentary confusion in the defending ranks from effective bursts of shell, to rush over the intervening space into the position. If, on the contrary, the distance from A to B were 300 or more yards and much exposed to the enemy's fire, it might be better to occupy the rear position, especially if the amount of dead ground were not great, or if any flanking fire could be brought upon it. But it is always a great advantage to the assailant if he can get over any considerable space of ground within range of the position under cover, so that the writer would always feel inclined to push forward the line to a point from which the maximum distance could be seen, unless it were actually seriously commanded by ground which the enemy could occupy.

Broken Slopes.

The next case might occur if the defensive force were defending a river valley, and would be where a more or less steep and broken slope rose from flat, level ground below, as fig. 2.

Fig. 2.



Ground of this nature was seen on the fields of Woerth and the Lisaine in 1870.

It is by no means easy to decide upon the best way of holding such ground. The slopes of the valley are very likely to be broken by lateral valleys and hollows, as at Woerth on the French side, and the slopes may be so rough, steep and broken as to render it difficult to command them thoroughly with fire. Each case must be judged on its own merits, but the following considerations may aid in coming to a decision.

In a case where lateral valleys or hollows exist, it is probable that the best position for the main line will be found somewhat retired near the heads of the lateral valleys or hollows. A fairly straight line will often be found in such a situation which can sweep with its fire the

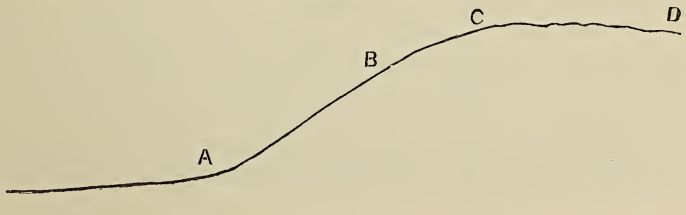
whole of the hollows and the flat upper surfaces of the spurs between them, and the extremities of the spurs can be held as detached advanced positions to command the slopes at the end of the spurs, which would be otherwise unseen. With this arrangement the assailant would be under fire the whole time of his advance:—if he attempted to pass up the hollows he would be met by fire in front and on the flanks, and if he attacked the spurs, should he capture them, which he might do, as they would be the weakest points, he would find himself confronted by the intact line behind. Naturally it would not be necessary to hold the rear line in force at first. The fire from the spurs would keep off the assailants until an attack was developed in force and pushed vigorously home, and then the rear line could be occupied at those points where danger became visible of the enemy overpowering the resistance of the advanced detachments.

If the line of high ground is fairly straight, but steep and broken, the choice will lie between placing the infantry line at the foot of the heights and the artillery on the summit, or placing both guns and infantry on the crest. The Germans on the Lisaine at Bethoncourt and Bussurel adopted the first course, using a low railway embankment at the foot of the heights as cover for the infantry line. They were probably right. Their rifles were shorter ranging than those of the French, and by placing their men at the foot of the slopes they got within effective range of the obstacle of the Lisaine and had a sufficient open field of fire over the flat meadows at the bottom of the valley. But there are disadvantages in such a position. It is very likely to be commanded by ground that can be occupied by the enemy's artillery, reinforcements are much exposed in an advance down the slopes, and if retreat were necessary the retiring troops would probably suffer greatly in falling back up the heights. The moral effects of such disadvantages would be likely to be serious in the case of troops not so convinced of their superiority to their enemies as were the Germans at the Lisaine, and therefore it would propably be generally best to place the infantry main line at the top of the heights, if the slopes could be fairly well seen or flanked and not much dead ground were the result. If necessary, skirmishing lines might be pushed forward to command an obstacle or see into dead ground, it being clearly understood that they were not to be reinforced, but that the decisive stand was to be made on the upper position.

Steep convex ground.

A very difficult case is presented by a high steep ridge with a convex outline in section, such as is presented in England very often by chalk downs. The section generally shows first at the top a gentle slope gradually curving over to a steep pitch, and then gentler slopes again at the foot, as in fig. 3.

FIG. 3.



Several situations for the defensive line may be found in the case of ground of this character, all of them having their own peculiar qualities. First, a line may be chosen at A at the foot of the steepest slopes. Here very often a good open range is obtained over glacis-like ground, but otherwise the position has many disadvantages. It is likely to be commanded within range by ground that can be occupied by the enemy, the supports would have to be in trenches in the slope above the line and very difficult to protect, reserves would have to move down the steep slope in full view of the enemy and retreat would be very hazardous.

The French at Spicheren did not occupy the lower edges of woods stretching down slopes of this nature, probably because they feared the moral effect on their men of the steep slopes behind them ; but, nevertheless, in the case of woods it may be sometimes necessary to come down the slope. Generally speaking, however, this low position would be undesirable. Secondly, a line may be taken at B at the edge of the steepest slope. From here all the ground in front is seen and commanded, but the position is some way down the face of the slope and may be exposed to the enemy's distant fire, and the covering of the men might be difficult, especially on chalk, where the surface soil is very shallow and the solid chalk is soon reached. It would, not, however, be desirable to give up the position B altogether and place the line at C, for that it would be to give up all power of bringing fire upon the steep slopes and the low ground and allow the enemy to get over a great deal of dangerous space unmolested. A good arrangement would be to keep back the bulk of the troops behind C during the early stages of the action and during the preliminary cannonade, and only place a thin line of picked shots at B, who would harass the enemy's deployments, and possibly his guns, if within range. Then, as the attacking infantry advanced, the line at B could be reinforced so as to increase the intensity of fire to the utmost, while reserves were brought up to C and kept just out of sight ready to make a counter-attack, if in spite of the fire the enemy should be able to get close to the line at B. A counter-attack delivered just as the enemy was on the point of rushing to the attack of that line, whilst still struggling with the difficulties of the ascent of the steep ground, would have every chance of success and, if successful, would preserve the line B intact and retain the command over the low ground.

Line retired on plateau.

Lastly, there is the situation some distance back on the plateau at D, but within musketry range of the crest C. This position requires serious and careful consideration. Certain writers, especially French, strongly advocate such a position, notably Commandant Paquié, as mentioned by Captain Mayne, R.E., in his work on "Infantry Fire Tactics" (p. 207).

The main arguments in its favour are these : firstly, whereas the position on the crest is exposed to, and can be rendered untenable by the direct fire of the assailant's artillery and infantry, in the case of the retired position the attack cannot be prepared by artillery fire from a distance, the guns of the attack must be brought up to the crest before they can prepare the attack, and it will be impossible to bring them into action there under the withering fire of the defender's infantry, and,

therefore, the attack, unprepared by artillery, must necessarily fail. Secondly, it is argued that if the position is taken up on the crest, all the bullets fired at the line, which are a little too high and pass over it, will sweep the ground in rear with a hail of projectiles, causing such loss among the supports and reserves as will prevent them from reinforcing the first line and making counter-attacks. The position held by the Germans at Villiers and Cocuilly in the investment of Paris and the events of the battle of Champigny are given as an instance of the successful employment of a line retired back from the edge of a plateau.

There is no doubt some force in these arguments, but there are very strong ones that may be urged on the other side. The main arguments against the retired position are these:—That as it is proposed only to occupy the crest by a weak line which is not to offer a strenuous resistance but to fall back when pressed, the enemy will be able to occupy the crest without using any very strong force and without calling up his reserves, and that, therefore, he will be able to get within effective musketry range of the defensive line without having suffered much and with all his reserves intact. When he has once dislodged the defenders from the crest, the latter lose all command over the ground in front of the crest, and the attacker's reserves can be moved freely and securely in any direction, and can be massed anywhere unknown to the defenders. This is most serious for the safety of the defensive line. In the case of Champigny, the German positions were part of a continuous investment line and therefore had no flanks that could be assailed, and the French were obliged to attack in front. But in the case of an ordinary position, it would often be most serious for it to be possible to mass large forces of the attack in positions whence they might be able to attack a flank at short distance unawares. Moreover, in many cases it would be possible to bring guns up under cover to the crest, and then push them forwards into action just over rising ground. In fig. 3 they could be brought up safely to B, and then pushed forward till they could just look over C, and would then be in a most effective position to prepare the attack, and it is at least doubtful if the musketry of the defensive line would be able to prevent their coming into action. Again, if the enemy were allowed to establish and perhaps entrench themselves on the crest, a counter-attack against them would be very difficult, and counter-attack is one of the most potent weapons of the defence. If, on the other hand, the crest is held as main line, a counter-attack delivered from it on assailants toiling up the front slope with no points of support or shelter nearer than the bottom would have the greatest chance of success.

But the strongest argument against the rearward position is derived from considerations of moral effect, the most important factor of all in deciding the fate of an action. Consider the effect on the nerves of the defenders of the main line of lying in inactivity in a position with no view beyond the crest close in front, of then seeing the skirmishers who have been occupying the crest come helter-skelter back at an early period of the action, and knowing then that the enemy has already got over all the wide space that can be seen from the crest and all the difficulties, whatever they may be, of the ascent of the heights and is

now posted, in unknown force, within a comparatively short distance of their line. Then think of the hours perhaps during which they will be exposed to fire from the captured position, certainly of musketry, often probably of guns also, while in absolute ignorance of what may be passing just beyond the brow of the hill, certain that a terrible blow is being prepared somewhere, but utterly unaware of the points on which it will fall or of what nature it will be. Then consider whether the *morale* of the defenders does not run a serious risk of being prejudicially affected, and whether the chances have not greatly increased of a panic setting in, when at last the assailants' preparations are complete and a forward movement begins, demonstratively everywhere, decisively at certain points, known to the attackers but entirely beyond the ken of the defenders.

The reasons for preferring the position on the crest will probably gain in strength by the introduction of smokeless powder, for it will seem akin to madness to give up the extended view over the movements of the enemy, shrouded no longer by clouds of smoke, that may be obtained from the crest, for a position from which little can be seen, and the advantages of which are after all more theoretical than founded on experience. For, as has been already mentioned, deductions drawn from an investment line cannot be considered generally applicable, and experience has hitherto failed to substantiate the supposed danger to the supports and reserves of fire directed on and missing the front line on a crest. Moreover, when smokeless powder is introduced the assailants will find it much more difficult to distinguish the exact position of the defenders even on a crest, and to direct the supposed insupportable fire upon them, so that another argument for the rearward line will be considerably weakened.

Observation posts and balloons, too, must not be relied upon to neutralise the disadvantages of losing the view from the crest; for, besides that, conditions of weather or of ground might render the observations from balloons or distant observing stations most insufficient, even if they provided the superior officers with the most perfect information, they could not counteract the bad influences on the men's *morale* which have been alluded to above.

On the other hand, the introduction of magazine rifles will no doubt render it more difficult for the assailant to attack the rearward position even if he has reached the edge of the plateau, and so far strengthens the argument for taking up that position. But still it must be a disadvantage to be driven with guns and all from the commanding position on the crest at any early stage of the action, and if it is replied that the crest should be held sufficiently strongly to enable the guns to maintain their position as long as required, that course commits the line on the crest to a serious fight, and it would surely be better to fight it out there than deliberately to withdraw to the rear position with all the risks incident to such a retreat.

Taking then everything into consideration, it would seem on the whole to be best as a general rule to make the crest the main fighting position, while the rearward position would make a very strong second line if it should happen that the first line was pierced at any point.

There may, however, be cases in which a rear line might be selected with advantage, namely, where an advanced line can be held at first in such a way as to make the enemy believe it to be the main line of defence and, when he has committed himself to a formal attack upon it, the defending troops can be safely withdrawn to the real position behind.

Such cases would only occur as a rule where a second line of heights can be found from which artillery could effectually cover the troops falling back from the first line, and so far in rear that its flanks are beyond the sphere of action of enveloping attacks made on the flanks of the first or false line.

Baker Pasha's action at Tashkesen in 1878 is a good instance of such a position and its advantages. A similar position could be found in England if it were necessary to defend the Guildford Gap from an enemy advancing from the south. To the east of Guildford an advanced line might be placed on the line of heights occupied by the Chantries woods and St. Martha's. Then the enemy would have to organise a regular attack on this line from which the defenders could fall back if their flank was turned, when the assailants would find another very strong line behind on the main chalk ridge.

Dispositions of Corps Commanders.

We have been up to this point considering the dispositions made by the Commander-in-Chief, his distribution of his Army Corps and the considerations which will guide him in deciding on the general line of defence he will select.

We can now go a step further and consider the dispositions of the Corps Commanders. The Commander-in-Chief will probably only have indicated the line to be held in the most general terms. The Corps Commanders will, however, indicate with some precision the limits within which the main fighting line of their Corps is to be placed, and also the localities that are to be specially looked after as pivots for the main and second lines, and will, at the same time, point out to their Divisional Generals the positions to be occupied by their Divisions. The question will arise whether all the Divisions of a Corps are to be placed in line or not. In the case when a Corps occupies a central position, so that its flanks are protected by the Corps on either side, and when it may be desirable to occupy as great a front as possible, the three Divisions may be placed alongside one another, but it is probable that in general a Corp Commander will wish to keep a substantial reserve in his own hands and will place only two Divisions in line on the position and keep the third in reserve. Especially will this be the case with flank Corps.

Dispositions of Generals of Division and Brigadiers.

Coming a step lower in the hierarchy we find the Divisional General with a certain portion of the front allotted to his Division, the general position of the fighting line indicated and the pivots pointed out to him. The lower in the hierarchy we descend the more detail will the Officer Commanding enter into. The Divisional General will probably first decide whether his two Brigades are to be placed alongside one another, or one kept in reserve. In a large force where Army and Corps reserves

have been already provided, the two Brigades of a Division will probably be placed alongside of one another, and one or two battalions of each Brigade retained as Divisional reserve. On an exposed flank one Brigade may be in rear of the other. The Brigadiers will then indicate to the Battalion Commanders the ground to be occupied by their battalions, and the Divisional Generals and Brigadiers will then superintend the actual posting of the troops, and give directions for the work to be done in preparing the position for defence.

Questions Coming Before Generals of Division and Brigadiers in Posting the Troops.

The broad situation for the fighting line having been selected by the Commander-in-Chief in the manner previously discussed, it will be arranged in detail, either in the open or along fences, or partly in the open and partly along fences in such a way that everywhere the best attainable view may be had over the ground in front, and the best cover possible may be obtained for the men consistently with this view. The selection of the actual line in detail will, as a rule, be the work of the Battalion and Company Commanders of the Battalions in first line, and the points that will principally come before the Divisional Generals and Brigadiers for consideration are cases where localities, such as woods, villages, farms, &c., are so situated as to break the continuity of what would be, generally speaking, the best line or where such localities lie a short distance in front of the general position of the line. In such cases it will be necessary for the Divisional Generals or Brigadiers to decide how the localities breaking the line are to be treated, and whether those lying outside it are to be held or not.

Localities in Line.

The question will not be very difficult when it concerns a group of buildings, village or coppice of no very great extent which breaks the line, for almost always it will be desirable, if not necessary, to hold them, and they will often form strong points from which adjacent parts of the line may be flanked.

Woods stretching towards enemy.

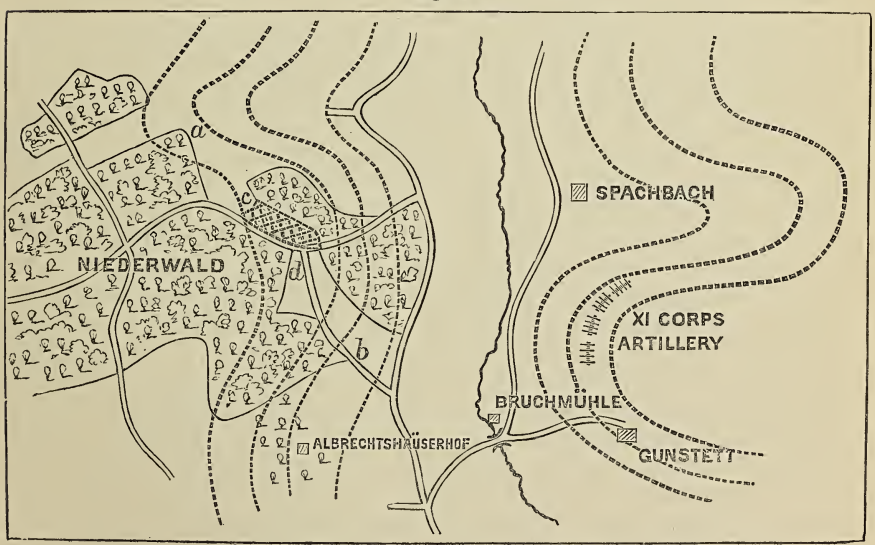
But the case is more difficult when we come across a wood stretching through the defensive line for a considerable distance towards the enemy, as is often the case with hanging woods on a hill side. Examples are found in the Niederwald at Woerth, in the woods on the Spicheren heights, and in the woods which are often found clothing the slopes of chalk downs in England. Cases of this nature present some of the most difficult problems that the defence of a position offers. If there are very extensive woods stretching from the defensive position right across to where the assailants will deploy, it would be better if possible to avoid the position altogether, but if that cannot be done every effort must be made to cut a belt through the wood behind which the defensive line can be placed, selecting for its position the situation where the least labour will be required, taking advantage of open spaces, thinner growth, &c.

If, on the other hand, the woods stop before reaching the enemy's deploying position, like the Spicheren woods and the Niederwald at Woerth, then the question will come up for solution whether the edge is to be held or not. The disadvantages of holding it are those already mentioned as inherent in positions at the foot of heights and those of pronounced salients; but, on the other hand, if it is not held oppor-

tunity may be given to the enemy of penetrating into the position and taking in flank some important point, as the Germans in the Spicheren woods took in flank the defenders of the Rotherberg. If there is any danger of this the edge of the wood should be held in spite of the disadvantages, but endeavours should be made to strengthen this, which must be a weak point, by cutting a belt further back near the crest and making abatis, with openings arranged for the retreat of the forward line, or by a retrenchment behind the rear edge, according to circumstances. Possibly there may be places further back than the extreme edge, where the wood is thin or open spaces narrow its extent. In such a case it may be better to take advantage of these thinner or narrower parts and make an opening there behind which the defensive line can be placed with a good chance of there fighting the enemy at an advantage, he being cramped by the conditions of the case and the defenders being probably considerably protected from artillery fire by the portions of the wood left standing in front. Magazine rifle-fire should make such a belt absolutely unassailable.

As an instance, take the Niederwald at Woerth. Here the edge of the wood was at the foot of the slopes, on which the French had their position, and exposed to the plunging fire of the German artillery on the Gunstett heights, a position tending to injure the steadiness of the troops holding it. The consequence was that the edge was only lightly held by the French, the Germans got in and, although driven back more than once by counter-strokes, yet gradually worked their way through and turned the French right. Now, behind the edge some way up the slope the wood narrowed very much, and a small amount of labour could have cut a belt (*c d*) in Fig. 4. This, in combination with the edges of the wood (*a c*) (*d b*) above the narrow part, would have provided a strong line which might have been held in force by the French with very good prospects of success.

Fig. 4.



Localities in front of main line.

We come next to the cases of localities, such as woods, coppices, villages, groups of buildings, &c., situated in front of the main line of defence. Considerable difficulty may sometimes be found in deciding what to do in such cases, and each one must be decided on its own merits. But some considerations may be pointed out which will help in arriving at a decision. Take first the case of woods and coppices. If the wood is very extensive it will, in almost all cases, be unwise to go into it, and the best course will be to entangle the near edge and place the defensive line behind it, in which case the enemy will find it very difficult to debouch from it. If, however, the wood or coppice is not very large it may be doubtful whether to occupy it or not. If it is not more than from 200 to 600 yards from the main line and large enough to contain an important force of men, it may be best to occupy it, as it will have a very considerable power of resistance, and if it were given up it would enable the enemy to bring up with little loss a considerable force to within dangerous proximity of the main line of defence. An instance of the advantageous occupation of such a locality is given by the La Folie coppice at Gravelotte. If, however, it is 600 yards or more in front of the main line, it will generally be best to give it up, bringing strong fire to bear on its nearer edge. Again, even if it is within that distance of the main line, if it is small and its further edge exposed to the enemy's artillery or stretching down a slope, it will usually not be worth holding, as its power of resisting the concentric attack that can be brought against it will not be sufficient to compensate for the sacrifice of its garrison, and even if occupied by the enemy it is not large enough to be of much use to him as a step towards the main position. If time permits of its being cut down it will not be of any use at all to the enemy, but it may not be always desirable to cut it all down if the trees are any screen to the main line from the enemy's artillery: in such a case entangling the nearer edge will be sufficient.

With regard to villages and buildings, it may be said that if they are of any extent and within effective musketry range of the main position, they ought to be held. It will be almost impossible with the time and means ordinarily available to destroy them so completely that the enemy cannot find cover in them, and if he does, he will use them as a base for further advance. Moreover, supported by the fire of the main line they should be capable of stubborn defence and therefore seriously delay the attack on the main line. If, however, they are small or far to the front, they had better be left alone—the nearer, smaller buildings being destroyed as far as possible. Villages some distance in front of the line are very awkward features, but if they stretch out a long way towards the enemy so as to give him the opportunity of partially encircling them without suffering much from the fire of the main line, they will not, as a rule, be able to hold out long enough to be worth the sacrifice of their garrison. At the same time, villages in front of the position in the hands of the assailants give the latter a great *pièd-à-terre* and seriously compromise the probability of successful counter-attack, as was seen in the case of the village of Woerth. Therefore, while villages far to the front and unfavourably situated as

regards power of resisting the enemy's attack should be left severely alone, yet there is a strong inducement to hold on to any that are strong in themselves, sufficiently near the position to be effectively flanked from it and, therefore, not too much exposed to an encircling attack. Villages consisting of scattered houses, straggling along roads, such as are so often seen in England, often give rise to much difference of opinion as to how they should be held. On the whole it seems best not to permit the defence to be attracted out too far to the front from one house to another, but to choose some zone parallel to the front where the defensive line shall be definitely placed, selected so as to have within it all strong and important buildings, and to have before it the maximum of clear space, and leave alone any scattered buildings there may be in front, levelling, if possible, or getting those nearest to the selected line.

A point that will be looked to during this inspection of the ground by the Divisional General and his Brigadiers will be the providing, as far as possible, of flanking fire to assist the defence of important pivots and to sweep ground imperfectly defended by direct fire from the main line. The most important points will be recognised by considering the situation from the point of view of an attacker, and noting where the decisive attacks are likely to be directed. This subject will be alluded to again in considering the employment of the artillery and machine guns.

Battalion Officers.

The Battalion Commanders having received their instructions from the Divisional General and Brigadiers, will then superintend the detailed installation of their own battalions. They will minutely examine the space allotted to their battalions, and determine in the first place how many companies shall be placed in the fighting line, and whether it is necessary to push forward any advanced parties or to double the line at any points. They may find that although the allotted line may generally command the ground in front, yet there are places which are hidden from it, and they will have to decide how to deal with these. It may be possible simply to fill them with obstacles, but in other cases it may be necessary to post an advanced party to command them. Again, there may be a spur jutting out towards the enemy, constituting a weak point, as being exposed to encircling attack, and here it may be desirable to double the line, the first portion holding the extremity of the spur, and the second being drawn across its neck. In short, the Battalion Commander should place himself in the position of an enemy advancing to the attack and note any features likely to favour the advance, and then devise means for parrying the danger.

The captain of each company will, in the meantime, arrange for the best way of utilising the fences, buildings or other features within the front to be occupied by his company, and select the exact position for trenches wherever he has to take a position in the open. These operations will be superintended by the Battalion Commander to ensure unity of plan. The best method for selecting the exact position for a line of trench is to deploy the men along the approximate line to be

taken up and then making them look over a point marked on their spade at the proposed height of the parapet, cause them to move backwards or forwards until they can just sweep with their eye the surface of the ground to be defended. In selecting the fences to be occupied and the positions for the trenches, the desirability of having as extended a clear field of fire as possible must be borne in mind. This can be obtained by advancing or retiring the line within limits, or by clearing the ground according to time and means available. If very little time can be spared, nothing can be done except to adjust the line to the best advantage to the accidents of the ground as they exist, but if time and means are available, the best results will be obtained by a combination of adjustment and clearing. Care must, however, be taken in clearing, not to do it in such a way as to enable the enemy to detect with ease the line that is occupied.

The detailed methods of placing buildings and villages in a state of defence, of preparing features of ground and of making trenches, will be found in all Text-books of Fortification.

Artillery and Machine Guns.

So far we have been considering the infantry line of defence. Another subject for the consideration of the superior commanders is the employment of the artillery and machine guns.

Theoretically, of course, the position for the artillery of the defence is on high ground somewhat retired behind the infantry line, so as not to be exposed to the musketry fire of the assailants, at least until they get very near. But as a matter of practice the opportunity for placing the guns in such positions will very often be absent. Either no high ground will be found behind the infantry line, or, if there is such, guns placed there may be unable to command the ground over which the enemy has to advance. Therefore the guns must often fight in line with the infantry, and there must be no hesitation in placing them there if circumstances demand it, though no doubt a rearward position is to be preferred if it can be obtained without impairing the efficiency of their fire. But no question of the safety of the guns must be allowed to interfere with the paramount consideration of obtaining the greatest possible value from their fire, and they must be placed wherever that is best attained, whether behind the infantry line, in it, or even before it if need be, as was the case with the German guns at the commencement of the battle of Noisseville.

In selecting positions for the guns, it must be borne in mind what their functions are during the different stages of the action. First they will have to engage the assailant's artillery and try to prevent its obtaining the upper hand, and then turning its fire on the points selected for attack, so as to prepare the way for the infantry advance. The guns of the defence must endeavour to draw as much as possible of the enemy's artillery fire on themselves, and so preserve their own infantry unharmed to meet the infantry attack. Therefore, the first condition to be sought for in an artillery position is the possibility of commanding with as effective fire as possible the ground on which the assailants are likely to bring up their guns. In a civilised country it is probable that this ground can be pretty clearly recognised before-

hand, as the features of the country, especially woods and trees, will limit the possible artillery positions. The guns of the defence should therefore be arranged so as to bring the utmost weight of fire upon such obvious artillery positions of the enemy, and render that fire as effective as possible by occupying points whence the enemy's line of guns can be taken obliquely as well as in front. As a rule the Divisional batteries should be kept together and in immediate connection with their own Divisions, and probably it will be best at first only to put in position the batteries of the Divisions in first line, keeping back to begin with the Corps Artilleries and the batteries of the Divisions in reserve. But positions (alternative if the ground permits) should have been carefully selected and prepared for the Corps Artilleries, and they should only be held back until it becomes evident where they will be best employed, for as much artillery as possible should be early brought into action, so as to prevent batteries from being destroyed by being subjected to the concentrated fire of a greatly superior force of artillery, and to keep the upper-hand of the enemy for as long as possible. The introduction of smokeless powder would diminish the danger of retaining the Corps Artilleries in hand at first, for if the Divisional Artilleries are skilfully placed, it will be very difficult for the enemy to make them out or rapidly overwhelm them. It may be a question whether the batteries of the Divisions in reserve should be kept back during the first phase of the action or not. Probably it would be best not to do so if a favourable position for their action could be found not far from where their Division is posted. For it is all important to hinder the enemy as long as possible from establishing a superiority of artillery fire. Until he can do so his infantry attacks will have small chance of success, and therefore it is worth while to use all possible guns to prevent his affecting this object, and until he does so they will not be wanted elsewhere. When, however, the defender's artillery is seen to be becoming manifestly overpowered, so that decisive infantry attacks may be expected, it will then probably be wise to withdraw the batteries of the Reserve Divisions so as to refit and replenish ammunition and be ready to act with their Divisions in repelling the assault, either by counter-attacks or reinforcing the line at the critical moment. Corps or Divisions, however, posted at a distance from the front, either on the flanks to meet turning movements, or elsewhere for any other purpose, would, as a rule, keep their artillery always with them.

The first positions, therefore, of the artillery will be chosen with a view to most effectively meeting the assailant's guns, keeping in mind, however, the further object of harassing the enemy's other arms, if he should attempt to bring them up or move them within range. After the preliminary artillery duel the next phase of the battle will be the infantry attacks. When these begin as many guns as possible should be turned on the advancing infantry. For this purpose they should be moved to such positions as will enable them to sweep with their fire the immediate foreground of the position, if they are unable to do so from their original situation. It is quite likely that the slopes immediately in front of the infantry line have not been visible from the ground

from which the batteries have been carrying on their duel with the attacking artillery. Possibly these slopes may be seen from a more advanced position, in which case the guns must be pushed forward if it is practicable to do so. But as they must have been already getting the worst of the artillery duel, for otherwise the enemy's infantry would hardly be venturing to attack, an advance of this kind will most likely present great difficulties. Therefore, the most careful examination of the ground should have been previously made to discover any positions to which guns could be moved under cover, and from which they can see the slopes in front of the infantry, either directly or in flank. A small amount of natural cover, a coppice, a hedgerow, or a few trees will often be found to facilitate such a movement and hide the guns in their new position. Smokeless powder, too, will render it easier for them to conceal themselves. Machine guns would be used to sweep any defiles and might be especially useful in flanking any otherwise dead ground, as their mobility would enable them to get into queer corners, and their unobtrusiveness would cause them to escape the enemy's notice from a distance.

For both artillery and machine guns, protection from view is of the utmost importance, much more so than cover from fire, which at the best can never be very effective, as the men must be more or less exposed when serving the guns. But if guns are placed, in the open even, some little distance behind any object which conceals them from view, such as a hedgerow, it is very difficult for the enemy to see whether his fire is effective or not, and even if he gets the range, a very little movement forward or back may put him out altogether and enable the batteries to work effectively and without much loss, under what would be an annihilating fire, if the enemy could only correct his aim. But either gun-pits or epaulments may be used where no better cover can be obtained. Or a nick cut in the reverse slope of a gentle rise gives very good cover.

Outpost Line, and Second or Rallying Line.

Hitherto we have been considering the main line of defence, but a properly organised position will have two subsidiary lines, one the Outpost Line, and the other the Second or, as it is sometimes called, Rallying Line.

Outpost Line.—The object of the Outpost Line is to give timely warning of the approach of the enemy, to prevent small hostile bodies from approaching and reconnoitring or harassing the main line, and further, in case of serious attack, to offer such a measure of resistance as will give the army time to take up its fighting position. The line will consist of picquets providing a chain of sentries, supports and reserves as laid down in the Regulations. The line of sentries or line of observation will be posted in the position from which the best view is to be obtained, and a line of resistance will be selected which will make use of all available localities which can be easily rendered defensible, such as groups of buildings, small coppices, &c.

It may often be found that localities, concerning which there has been some doubt as to whether they should be included in the main

line of defence or not, and which it has been finally decided should not be held, will form good supporting points for the line of outposts. No definite rule can be laid down as to the exact situation of the line of defence; it may be at the line of supports, or of picquets, or even at the line of sentries if the same line is best, both for defence and for keeping watch over the country beyond. In the last case the picquets and supports should be drawn nearer to the line of sentries. It may happen that the line intended as the main line of defence of the position is occupied by the outposts and that the army is bivouacked some distance in rear of it. In this case the outposts must be strengthened, in order that they may be able to maintain themselves in the position till the rest of the army can take its fighting stations. Whatever line is chosen for the line of defence of the outposts should be strengthened by works of fortification to such an extent as to place the outposts in the best conditions for delaying the enemy, but care must be taken neither to afford cover to the enemy, nor to cause impediment to counter-attack.

Second or Rallying Line.—This line has for its objects, to arrest the successful advance of the enemy should he succeed in penetrating the main line at any point, to prevent him from utilising his success for further advance, and to form an *appui* for counter-attacks by which to dislodge him from the positions he has gained. The 2nd line would not as a rule be continuous, but would consist of a certain number of favourable localities, strengthened by fortification. Then, if the enemy got possession of any part of the main line, he would find himself confronted by one or more of these strong points and unable to follow up his first success until he had brought up guns and prepared the way for a further attack on these points. Meanwhile the General of the defensive army would prepare a force for counter-attack under their protection as rapidly as possible and launch it on the enemy before he could consolidate his position. This attack, supported by the fire of the pivots of the 2nd line and of guns in the intervals between them, would have the best chance that could be obtained of retrieving the first disaster. These being the functions of the pivots of the 2nd line, they should be selected so as to fulfil them in the most efficient manner. That is to say, they should be able to see the whole of the main line, especially the points where there is most danger of the enemy penetrating, they should have a clear field of fire and be of sufficient size to conceal dispositions made behind them and furnish a considerable amount of fire. Covered positions for guns on their flanks would be very desirable. If, from the nature of the position, there should be any portions of the main line which cannot be commanded by the pivots of the 2nd line, these portions must be recognised as weak points and, if possible, retrenchments should be made to them which can be commanded by the 2nd line. The pivots of the 2nd line would be strengthened by Field Fortification in the usual manner.

Lines of Troops.

It may be as well to say a few words here on the subject of Lines of

Troops, a subject which does not seem to be quite clearly defined under modern conditions. In the days of linear tactics armies were actually drawn up in two or more definite lines, as for instance the English army at the Alma, but the case will be different in these days. Bodies of troops will have a certain length of front assigned to them, but they will not be necessarily arranged in definite lines within that front, but each unit will have its own reserve which will for it act the part of 2nd line. So that in the case of a large force there may be several distinct 2nd lines according to what unit we are considering. For instance, in the example we have considered of an army consisting of several Army Corps we have supposed the front to be divided between three corps, each of which places two Divisions in 1st line and keeps one back in reserve. This reserve Division acts as 2nd line to the Corps. Then each Division places a certain number of battalions in front line and keeps the remainder in reserve, acting as 2nd line to the Division; similarly a Brigade may keep one or more battalions in its 2nd line, and finally the battalions in fighting line will have a certain number of companies deployed and the rest as battalion reserve or 2nd line. So there will not be one definite 2nd line for the whole army, but each unit will have its own reserve which will act as its 2nd line, and which will be in turn employed to feed the fight or to make attacks in any direction that may be required. This refers, of course, only to the troops themselves; as regards the field of battle, the 1st or main line of defence (mostly continuous) and the 2nd or Rallying line (generally discontinuous) will, as a rule, be clearly defined for the whole position, the 2nd line of defence being generally occupied by troops belonging to the reserve or 2nd line of the larger units.

It may be necessary or desirable to keep much smaller proportions of each unit in reserve if a long line has to be held by a small force. For instance, a Corps Commander might only keep a brigade in reserve instead of a Division, and other units might be distributed in similar proportions. But the same principles would apply though the proportions might be changed.

Position of Cavalry.

The main force of the cavalry will probably be posted on the flanks, especially that which is most exposed, and would have to encounter the enemy's cavalry as it tries to pass round the flanks of the position, and must do its utmost to save the flanks and rear of the army from being attacked. It must also endeavour to detect any turning movement of bodies of all arms. Further remarks on the employment of cavalry will be made when considering the conduct of the Defence.

Engineers.

The task of the Engineers will be to superintend the work that has to be done by working parties, to prepare the position for defence, and to carry out themselves such operations as require skilled labour. When these tasks are completed they would probably join the reserves of the units to which they are attached, so as to be ready for any employment that may call for their services during the battle.

Conduct of Defence.

Having considered the manner in which the troops will be arranged in the position, it may be well to outline the method in which a defensive action will be conducted.

The outpost line will repulse as long as possible the attempts of the enemy to reconnoitre and the advance of weak bodies, so as to prevent the army from being harassed, unless a general action is impending. The commencement of the latter will usually be heralded by reconnaissances in force, some of which may force back the outposts and must then be checked by the main line. The enemy will also begin to deploy masses of artillery. When this is observed the artillery of the defence will do its utmost to prevent the assailant's artillery from getting the upper-hand. It may be possible to put infantry in ambush in positions from which they could bring destructive fire on the guns if they made a rash advance, or possibly cavalry might be so posted as to have a chance of surprising them.

The next phase of the action will be when the artillery of the defence is being overpowered and the attacking infantry advances. All available guns will then be turned on the infantry and the main line of defence will be occupied by a firing line of infantry, in full strength where the main attacks threaten, thinly at other points: supports and reserves will still keep under cover, but the casualties in the firing line will of course be filled up as they occur. If the musketry fire of the defence can be kept up, it is hardly possible that the enemy will be able to advance to the assault against it. But two alternatives must be considered—firstly, a flank attack, and secondly, such a concentration of fire upon some points in the front as to reduce the defenders to silence. In the first case the flank attack will be met by the troops posted on the flanks for that purpose, either prolonging the original line, or occupying a second position in rear or themselves attacking the troops making the turning movement. In the second case, if the defenders are silenced or nearly so at certain points in the front, the local reserves will be prepared to make counter-attacks when the enemy get within reach and is wearied with his previous exertions.

Whilst the infantry attacks are going on the artillery must strain every nerve to assist their own infantry in repelling the attacks, and on no consideration must guns be withdrawn out of action,[1] but they must be fought to the last, as the very last round may turn the balance and decide the repulse of the attack. Every endeavour should also be made to support the counter-attacks by flanking fire from other parts of the line. Counter-attacks made at the right moment and vigorously carried out will have many chances of success, especially if they can be made on the flank of the assailants. If they are not successful, however, and the enemy gets possession of some part of the 1st line, he will be checked by the pivots of the 2nd line, and under their cover measures should be at once taken to attack him in turn before he has had time to recover from the inevitable disorder of even a successful attack, consolidate his possession of the conquered ground and

[1] Except those belonging to bodies in reserve as previously mentioned.

bring up guns. The general reserves will probably be used for this. If unsuccessful, and if the enemy is able to utilise his first success for further advance and the position is no longer tenable, or if flank attacks have proved successful, all that remains is to withdraw the army in as good order as possible under cover of any intact reserves and of the cavalry and artillery.

The possibility of attack by masses of cavalry must not be forgotten. It is probable that on most battle-fields there will be only certain places where such attacks could occur, for they would only be possible where cavalry could get within 1000 yards or so of the infantry under cover. In such places the greatest care should be taken that infantry are never allowed to be exhausted to such an extent that intact bodies are not at hand to meet cavalry. It is only if infantry are entirely exhausted that cavalry attacks would have a chance of success. On the other hand, in a long fight there may very possibly be periods when the infantry of the attack is temporarily exhausted, and it would therefore be desirable to post any cavalry that can be spared from the flanks in positions from which they could sally forth unawares on the attacking lines. But, as mentioned before, in all probability the bulk of the defender's cavalry would be required on the flanks.

Precautions Against Night Attacks.

It only remains further to indicate the precautions to be taken to guard against night attacks. Of course, it is of the first importance that the outpost duty should be efficiently carried out so as to prevent the enemy from being able to approach the position without ample warning. It is further necessary that the troops who are to form the firing line with its supports and immediate reserves should bivouac sufficiently near the portions of the line they are to occupy as to be able to take up their position at the first alarm and be arranged without confusion before the attack comes upon them. Their bivouacs should also be so arranged that they have direct access to their own portion of the line without units having to cross one another. It is necessary that the whole line should be occupied continuously so as to prevent the enemy being able to penetrate anywhere unawares. As regards the various reserves, they would be distributed along the line somewhat as they would be in the daytime, but it must be remembered that turning movements are improbable at night, both on account of the difficulties that would attend circuitous marches, and because the darkness removes the great reason for their being adopted, namely, the murderous effect of frontal fire with modern weapons, when a clear view can be obtained over the ground. Therefore it is probable that the main attacks will be made on the keys of the front of the position, and reserves should be at hand to meet such attacks. Artillery will have little scope for action at night, but machine guns may very usefully be laid before nightfall to sweep defiles or to bring flanking fire in front of localities considered especially liable to attack.

EXPERIENCES AT OKEHAMPTON.

REMARKS ON CAPTAIN WHITE'S LECTURE.

BY

MAJOR C. R. W. HERVEY, R.A.

In Captain White's lecture, on "Experiences at Okehampton," he states at the close that, "in the opinion of most officers, the marks for Fire Discipline should be increased;" "the marks at the disposal of the umpire not being sufficient to adequately discriminate between the various shades of excellence to which the batteries have been worked up." Also, that "there is an advantage in limiting the time, and not the ammunition," because of some difficulty in awarding credits for time.

I propose to traverse both these opinions, chiefly from a Garrison Artillery point of view, though I believe the same principles will be found to hold good in both branches of the artillery.

I will take "Fire Discipline" credits first, and begin by stating my opinion that the excellence of the Fire Discipline of a battery is best shown by the accuracy and rapidity of its fire; and that these are best tested by the aid of targets and the stop-watch, and not by the discrimination of an umpire. In illustration of this opinion, I will give my experiences of a competition between three batteries of Garrison Artillery, in which I took part, and in which I submit that credits for Fire Discipline played too conspicuous a part. I will call the batteries X. Y. and Z. The competition took place from six 9-inch R.M.L. guns, over a sea range, at a moving target representing a battleship. The credits awarded by the umpire were as follows:—

	Accuracy. 150.	Rapidity. 50.	Fire Discipline. 100.	Total. 300.
X.	78	— 20	94	152
Y.	115½	25	91	231½
Z.	122	30	77	229

It will be seen from the above score that the prize was not given to the battery which combined the greatest accuracy with the greatest rapidity of fire. Can this be considered satisfactory? More especially when it is remembered that credits for accuracy and rapidity are founded on fact, while those for Fire Discipline are founded on opinion. Again, in X.'s score we see almost perfection in Fire Discipline, accompanied by inaccurate and slow fire. Surely this is not calculated to increase

a competitor's faith in, or respect for, Fire Discipline credits; yet these credits decided the award. To get the greatest effect from a given expenditure of ammunition in the shortest time would appear to be the very essence of Fire Discipline; yet Z., who did this, loses the prize under the heading of Fire Discipline credits.

And, lastly, if there be a circumstance, in which "the highest results can only be obtained by accuracy and rapidity of fire combined," the case of a fort firing at a battleship trying to run by, is that circumstance.

I will next show that, when the ammunition is limited and not the time, a very simple and fair method of scoring is possible, and that the present rule (Appendix C., p. 25) is bad, because it is founded on no principle. No one will dispute that (leaving the number of rounds fired out of the question), first, the value of the fire of batteries varies directly as the credits for hits in a given time. Thus, a battery scoring 100 in ten minutes is twice as effective as one scoring 50 in ten minutes. Secondly, that the value of their fire varies inversely as the time. Thus, a battery scoring 100 in ten minutes is twice as good as one scoring 100 in twenty minutes. Granted these two facts, we are now in a position to determine the credits due to any number of batteries, shooting under the same conditions, for accuracy and time combined, whose score for hits and whose times of firing are known. Let us proceed to do this in the case of X. Y. and Z. and two other batteries, say W. and V. The times, as given by the umpire for X. Y. and Z., were—

X. 19 minutes 58 seconds, for ease of calculation, say 20 minutes.
Y. 11 ,, 24 ,, ,, ,, ,, 11 ,, 20 secs.
Z. 10 ,, 4 ,, ,, ,, ,, 10 ,,

We will suppose V. scored 150 in 16 minutes, which was the fixed time given by the umpire, and that W. scored 150 in 6 minutes, which was the time it was necessary to fire the rounds in, in order to get the full credits 50 laid down (p. 25). (This necessitated firing five rounds from each of three 9-inch guns in six minutes, and was well calculated to cause wild shooting).

Taking 16 minutes, therefore, as the standard by which to determine the relative values of these batteries, for accuracy and rapidity of fire combined, we find as under :—

$$\text{V. scores } 150 \times \frac{16}{16} = 150$$

$$\text{W. } \,,, \; 150 \times \frac{16}{6} = 400$$

$$\text{X. } \,,, \; 78 \times \frac{16}{20} = 62{\cdot}4 + 94 = 156$$

$$\text{Y. } \,,, \; 115\tfrac{1}{2} \times \frac{16}{11\frac{1}{3}} = 163 + 91 = 254$$

$$\text{Z. } \,,, \; 122 \times \frac{16}{10} = 195 + 77 = 272$$

Can any one doubt that the above scores are correct, and, if not, we have a fair measure of the unfairness of the present rule. The only score which the present rule would endorse is, V.'s score, and W.'s score would have to be halved under it, 200 being the total for full credits for accuracy and time. Of course, if V.'s score is 150, W.'s can be nothing else but 400. If the umpire's credits for Fire Discipline in the case of X., Y., and Z. be added, it will be seen that Z. wins, and he also wins if Y.'s time of 11 minutes 20 seconds, or his own time of 10 minutes be taken as the standard for comparison; that he did not do so in reality is certainly hard on him.

Whether the ammunition be limited and not the time, or the reverse, should not affect the principle of awarding credits that is by the "rate of hitting." And this method of scoring is equally simple in either case, being in fact identical.

Whoever tries to separate credits for accuracy, from credits for time, tries the impossible; neither is of any value without the other, and neither can be rightly judged of, except in conjunction with the other—therefore I sympathise with Captain White when he says time allowances are never satisfactory or understood by the men, only I should like to be included in the men.

The reason credits for accuracy (dummies disabled) are satisfactory in the Field Artillery competition is, because the number of hits are taken in conjunction with the fixed time for each series. To get satisfactory time credits you must take the time in conjunction with a fixed number of hits, which will give you the same result, as far as the relative value of batteries is concerned. What you get in each case is their relative rate of scoring or hitting. For example, suppose A. makes 100 hits in 8 minutes, and B. makes 150 hits in 16 minutes—16 minutes being the fixed time—the present rule trying the impossible, comes to grief and makes B. win; thus A.'s score is 100 for accuracy, plus 40 for time—total 140; B.'s score being 150. The scores should be—

$$\text{A. } 100 \times \frac{16}{8} = 200. \qquad \text{B. } 150 \times \frac{16}{16} = 150.$$

And A. wins, always supposing the number of rounds fired is left out of the question. If we reverse the process, using a fixed standard of hits, say 75, we get—

$$\text{A. scores } 8 \frac{75}{100} = 6. \qquad \text{B. } 16 \frac{75}{150} = 8.$$

Their merits are, of course, inversely as their times—therefore A.'s score is to B.'s as 8 to 6, which is the same as 200 to 150. On the whole I prefer making the number of hits the starting point from which to calculate the rate of scoring, using a "fixed" time. To do this it is not necessary to "limit the time and not the ammunition." If the ammunition be limited and not the time, take the score for hits, divide it by the time in minutes and fractions of minutes, and multiply it by the "fixed" time in minutes, the result will give the score for accuracy and time combined.

I will now consider the desirability or otherwise of leaving the number of rounds expended out of the question; in other words, should accuracy from an ammunition point of view have credits given it? (That is for hits per shell).

In the case of X., Y. and Z., not only was Z.'s rate of scoring greatest, but he got the greatest number of hits per shell, the relative merits of the three batteries in this respect being represented by their score for hits, each firing the same number of rounds.

But in the case of A. and B., ammunition limited and not time. Though A.'s rate of hitting was greater, B. made the greatest number of hits, their merits from an ammunition point of view being represented by the scores—A., 100; B., 150. We have already seen that their rate of hitting is represented by the figures—A., 200; B., 150. Therefore, if we add them together we get the total scores as under:—

A., 200 + 100 = 300.
B., 150 + 150 = 300.

And they come out equal. Now in the case of Garrison as compared with Field Artillery, the former is stationary, its stores of ammunition are close at hand, and not likely to run short.

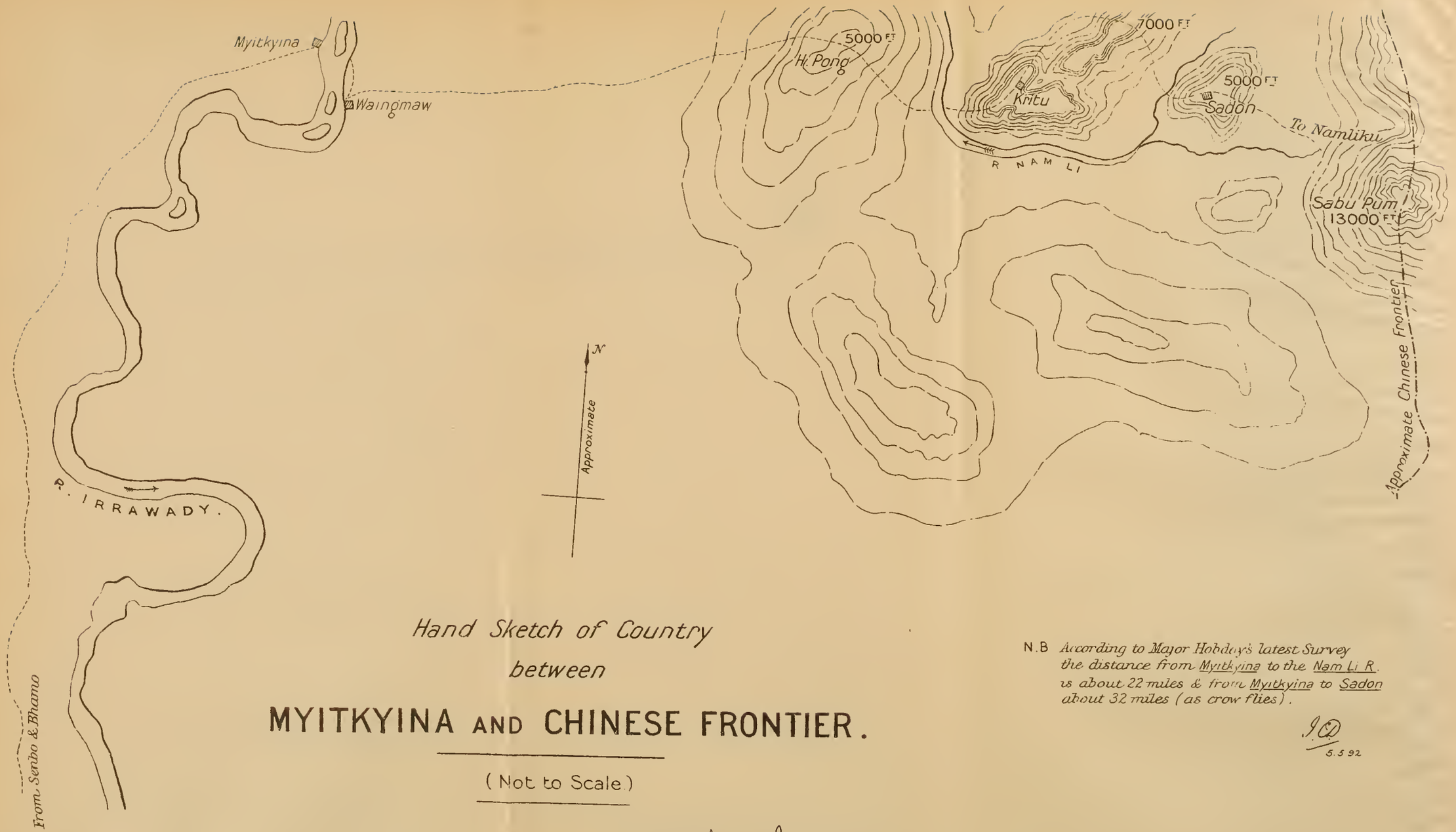
We may therefore, I think, disregard the question of ammunition (hits per shell credits) in their case and certainly leave A. in possession of the prize.

But, in the case of the Field Artillery, its stores of ammunition have to follow it about all over the country day after day, and that part of its lesson in Fire Discipline, which teaches it to get the most effect from a limited supply of ammunition, should not be entirely lost sight of; for at certain stages of the fight that battery would not necessarily be the best which, at a much greater expenditure of ammunition, only made a few more hits. Here, I think, the question of ammunition expended fairly enters, and a system of credits for hits per shell might have a slight share in determining the respective merits of the batteries. Of course, to do this, it makes no difference whether the ammunition is limited and not the time, or the reverse, but limiting the ammunition has this practical advantage, that you know exactly how much you will expend, and the firing is not so likely to be hurried during the last minute after "Cease Firing" has sounded.

It seems to me, for the foregoing and other reasons, that there is more scope for credits for Fire Discipline, as distinct from credits for rate of scoring, in the case of the Field than in the Garrison Artillery, and it is difficult to understand why these credits should form one-third of the total for Garrison Artillery and only one-seventh of that for Field Artillery.

Exactly in proportion as the umpire's award is given, in accordance with sound principles and proved facts, it will carry conviction and receive the assent of the competitors. I would strongly (and humbly) urge that the Fire Discipline credits for Garrison Artillery be decreased, and that those of Field Artillery should not be increased without further experience.

GUERNSEY,
5th Feb., 1892.



Hand Sketch of Country

between

MYITKYINA AND CHINESE FRONTIER.

(Not to Scale.)

N.B *According to Major Hobday's latest Survey the distance from Myitkyina to the Nam Li R. is about 22 miles & from Myitkyina to Sadon about 32 miles (as crow flies).*

J.C.D.
5.5.92

(sd) [illegible]
Lieut R.a.
Feby 1892.

Intell. Div. W.O. No 898

Harrison & Sons, Lith., Mortimer Street, W.

Hand S

MYITKYINA AN

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Intell. Div. W.O. No 898.

OPERATIONS

OF THE

IRRAWADY COLUMN, UPPER BURMAH.

BY

LIEUTENANT G. F. MACMUNN, R.A.

Sadon is a large Kachin village, about 40 miles east of Myitkyina, a village on the Irrawady about 100 miles above Bhamo, our most northern military station in Upper Burmah. Sadon is only 12 miles from the frontier of China, about 4500 feet above sea level, and above it the hills stretch into China to a height of 13,000 feet. Though in our territory it had never been visited by British troops or officials till December, 1891—some nine months before, when an exploring party of 50 mounted infantry, under Major Hobday (of the Survey of India) and Captain Elliot, were turned back by the Kachins at the Nam Li River some 18 miles from Sadon, and told that if they crossed the river they would be fired on. The party accordingly retired, promising, however, to return the next year. In addition to scornfully rejecting our overtures the people of Sadon had also offended by harbouring the Wantho Tswaba and other outlaws. Accordingly a column left Bhamo about the middle of December, 1891, under Major Yule, Devonshire Regiment, with Lieutenant Holman, as staff officer, consisting of two guns No. 6 Bombay Mountain Battery, under Lieutenant Brownlow, R.A. (attached from No. 6 Bombay Mountain Battery), 50 men of Burmah Sappers and Miners, under Lieutenant Harrison, R.E., 100 men of the Devonshire Regiment, 200 men 3rd Burmah Regiment, 50 men 23rd Madras Infantry, with some 450 Panthay mules as transport, and 10 elephants to work the line of communications. The column left Bhamo on the 14th December, and on the 15th and 16th assembled and established a base at Senbo; leaving Senbo on 17th, the column arrived at Myitkyina on the Irrawady on 23rd, crossed the river on 24th, some 300 yards broad, by rafts, and arrived at Kritu, some three miles beyond the River Nam Li, where Major Hobday had been turned back the year before, on the 28th. During the night a few shots were heard in the jungles round, supposed to be signal shots. Several rumours had reached the column that 800 Chinamen had arrived in Sadon, which is about 12 miles from Kritu, to assist in the defence. On 29th the column left Kritu and crossed the Tingari stream which is the

boundary of the Sadon territory; three-quarters of a mile further on shots were heard ahead, and the Ghoorkas extended in front, discovering a stockade blocking the narrow road where it crossed a nullah. The stockade was very strongly built of stones and logs, with abattis in front. The Kachins opened a heavy fire from it, and beat gongs and cheered. The jungle was so thick that the guns could only fire into it from a turn of the road 100 yards from the stockade; two shell were fired by one gun from this position and the stockade carried at the point of the bayonet. Six Kachins were killed, wounded unknown —our loss two Ghoorkas and one gunner slightly wounded; one gun-mule wounded.

On 30th the column divided and attacked the adjacent villages of Sadon and Scintong, the enemy firing pretty heavily, but with little effect; our loss two Devon men, and one sapper slightly wounded.

After taking Sadon the troops halted there till the 14th January, the Political Officer, Captain Elliot, visited all the villages round with small escorts, and the sappers commenced building a post on a hill some 600 feet above Sadon. From 14th to 23rd the column adjourned to the Chinese frontier, visiting all villages *en route*; about 150 men being left in Sadon to complete the post. On 23rd the column returned, and stayed at Sadon till the 5th of February; the work at the post continuing. By this time all the surrounding country was considered quite friendly, and the inhabitants were supposed to be beside themselves with joy at our presence. On the 5th Major Yule started off with the column, taking 25 days' rations, intending to cross the 'N Maika river and visit Sadon-Cong, where the Kachins were reported to be stockading themselves. The people of Sadon-Cong also had been raiding on some villages friendly to us and required bringing to order. The column had two days desultory fighting at Sadon-Cong, their camp being twice attacked at night; our loss one Ghoorka wounded and four mules killed. While the column were thus employed the friendly peasantry were enjoying themselves at Sadon. The day the column left all went well; the troops left behind were 50 rifles 3rd Burmah, 50 rifles 23rd Madras Infantry, 48 Burmah Sappers and Miners, about 20 Ghoorkas, of whom 12 were invalids, and seven invalid Europeans. The garrison was under command of Lieutenant Harrison, R.E., with whom was Lieutenant Perry, 23rd Madras Infantry, their orders were to work hard at completing the post. The post consisted of a stockade of young saplings some six inches diameter; all round about six feet up was a line of bamboo spikes called pangies—and a small ditch round the whole—accommodation was being made for 250 rifles. On February 5th it was in a very unfinished state, and the surrounding jungle had only been cleared for about 80 yards round the post; on February 6th Lieutenant Harrison was visited by some of the head men of the neighbouring villages and compliments exchanged. The afternoon of the same day crowds were seen collecting in Sadon and pouring in from the country round.

The easiest way to give an idea of subsequent events will be to state them in diary form.

February 7th.—Kachins hoisted flags in Sadon, shots were heard;

one Sepoy on guard outside the post severely wounded and two others during reconnaissance. Lieutenant Harrison sent out a party to reconnoitre; they reported several hundred Kachins in Sadon and the village barricaded. He ordered all men inside post and took all military precautions. Total losses two men severely, one slightly wounded.

February 8th.—Kachins attacked post in large numbers (700 or 800 at least) firing incessantly all day and night from surrounding jungle; our loss one man severely and two men slightly wounded. The great difficulty in the post was scarcity of water, one spring being 250 yards below the post, another 400 yards. Lieutenant Harrison twice sallied out and cleared the jungles nearest the fort, but directly he retired inside the fort the Kachins returned. The rest of the day was spent in filling empty ration bags with sand, constructing impromptu gabions, making precautions against fire, and defending some of the flanking tambours with kit bags, etc. The inside of the fort rose above the *terreplein* of the stockade, and was swept by the enemy's bullets; loss, one native officer slightly wounded, one Sepoy severely, one slightly.

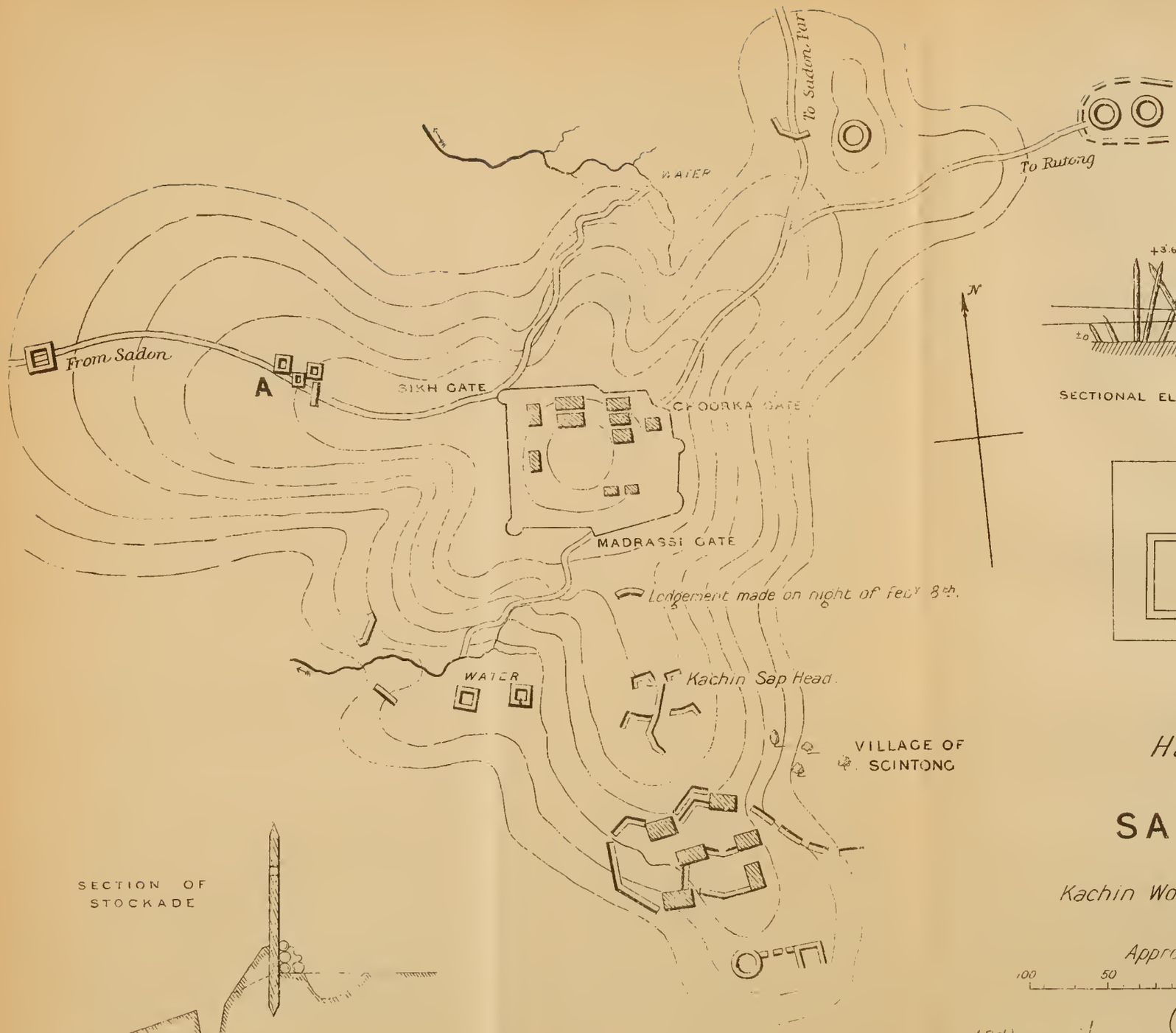
February 9th.—The garrison was obliged to go out for water, and to do this the enemy had to be turned out from the vicinity of the water. They were found to be strongly entrenched and stockaded. In turning them out four of our men were killed and three severely wounded, water was got in and ten stockades were destroyed by the garrison. During the night of the 8th the Kachins had come up and established a lodgment behind a rock only 80 yards away from a stockade. Lieutenant Harrison turned them out of this with a hand grenade; it was found that the Kachins had made gabions and filled them with earth; the gabions were beautifully made and filled the sappers' hearts with envy. The garrison retired inside the post about 3 p.m., as the enemy had come up in large numbers, and great difficulty was experienced in bringing in the wounded men; one had been killed and one severely wounded 15 yards from a stockade at the head of the village of Scintong, some 300 yards from the post. This stockade was surrounded by *chevaux-de-frise*, and extended into the impassable jungle. As we had already lost many men and it appeared impossible to capture the stockade without losing more men than the small garrison could afford, Lieutenant Harrison ordered the men to retire. Two wounded men of the Madras Infantry were brought in by four Sikhs of the 3rd Burmah Regiment under a heavy fire—two of them were wounded in so doing—and one of them subsequently died of his wounds. The three survivors have been recommended for the Order of Merit.

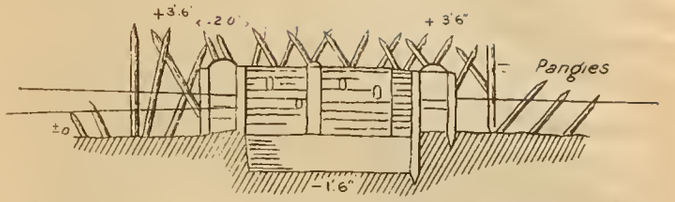
The garrison captured ten stockades during the sorties of the 9th.

About 7 p.m. the garrison heard firing in the valley below Sadon, and shortly afterwards were agreeably surprised at hearing a British cheer some 300 yards from the post, and the writer of this arrived with 12 men and a native officer of the Mogany Ghoorka Levy Mounted Infantry.

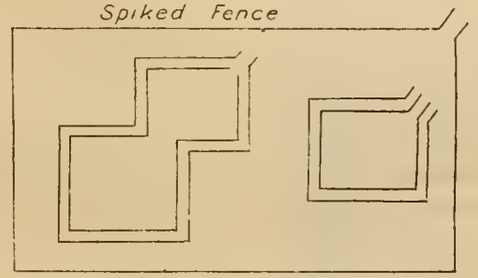
I will now give a short account of my adventures before continuing the diary of the siege.

On 7th February I left Myitkyina on my way to join No. 6 Bombay Mountain Battery to relieve Lieutenant Brownlow, I had intended to make four marches arriving on 10th at Sadon. At Myitkyina I was told that an escort was really unnecessary as the people were so fond of us, but as a jemadar and 12 sowars Ghoorka Mounted Infantry were going up I might take them. I had with me 15 mules carrying rum, which was urgently required. On morning of 9th I left H. Pong at 6 a.m., intending to halt at Kritu some 11 miles from H. Pong. About 8.30 a.m. a hatless sowar of the advanced party galloped back with his sword drawn and informed me that the jemadar and four men had been fired on crossing the Nam Li, and a pony had been shot dead. I hurried on with four men, leaving our horses with two men to wait for the convoy. I met the advance party returning, and with them advanced to the river and extended on the bank; I had with me the jemadar, who was a Sikh, and eight of the Ghoorkas. The Kachins greeted us with a volley from 40 or 50 pieces. On reconnoitring I found that their line consisted of stockades on the opposite bank for about 120 yards; leaving the jemadar and five men lying down opposite the stockade, I crossed the stream, which was about 70 yards wide, with three Ghoorkas, some 80 yards lower than the ford. The Kachins fired heavily at us, but luckily hit no one, though the water round us flew up. The river was about four feet deep and very rocky. We got into the flank of their trenches and turned them out of half, I then sent for the rest of my party and cleared all the trenches. The Kachins bolted through the jungle leaving an enormous quantity of cooked food in their trenches. I waited for the convoy and ponies, and pushed on on foot. The road was blocked with fallen trees; we heard the enemy in the jungle, but they only fired a few shots. We arrived at Kritu about 11 a.m., and found the village empty; I resolved to try and push on to Sadon, another 12 miles. No sooner had we left the village than a hot fire opened on us from the jungle and rear. I placed four men as rear-guard to fire occasional volleys, closed up my convoy, and, with the jemadar and five men with me ahead, we pushed on and on; the rest of my men had to hold the mounted infantry ponies. The Kachins, augmented by the population of several villages we passed through, followed us in the jungle for miles, firing incessantly, but luckily hitting no one. About six miles from Sadon, on the top of a hill 7000 feet high, a volley was fired at us from a stockade built across the road; this was concealed by a bend, and we did not see it till they opened fire on us at about 100 yards range. The jemadar fell shot through the chest while standing beside me. A Ghoorka was grazed on the foot, having half his boot carried away. I pulled the jemadar into the jungle, and made my men lie down while I formed my plans. It was impossible to rush the stockade, as heavy abattis had been made in front of it, so I determined to go down the side of the hill and come up again on the flank of the stockade, accordingly with two Ghoorkas I crossed the road, leaving three others lying down in front. As we crossed the enemy fired a volley at us, one shot hitting me in the left arm, luckily missing the bone. We proceeded to cut our way down and up again through the thick jungle,





SECTIONAL ELEVATION OF KACHIN EARTHWORK A.



PLAN OF Dº.

SECTION OF STOCKADE

Hand Sketch of SADON POST.

Kachin Works shewn thus ..

Approximate Scale for Plan.

100 50 0 100 200 YARDS

(Sd) Arthur Munn Lieut R. A
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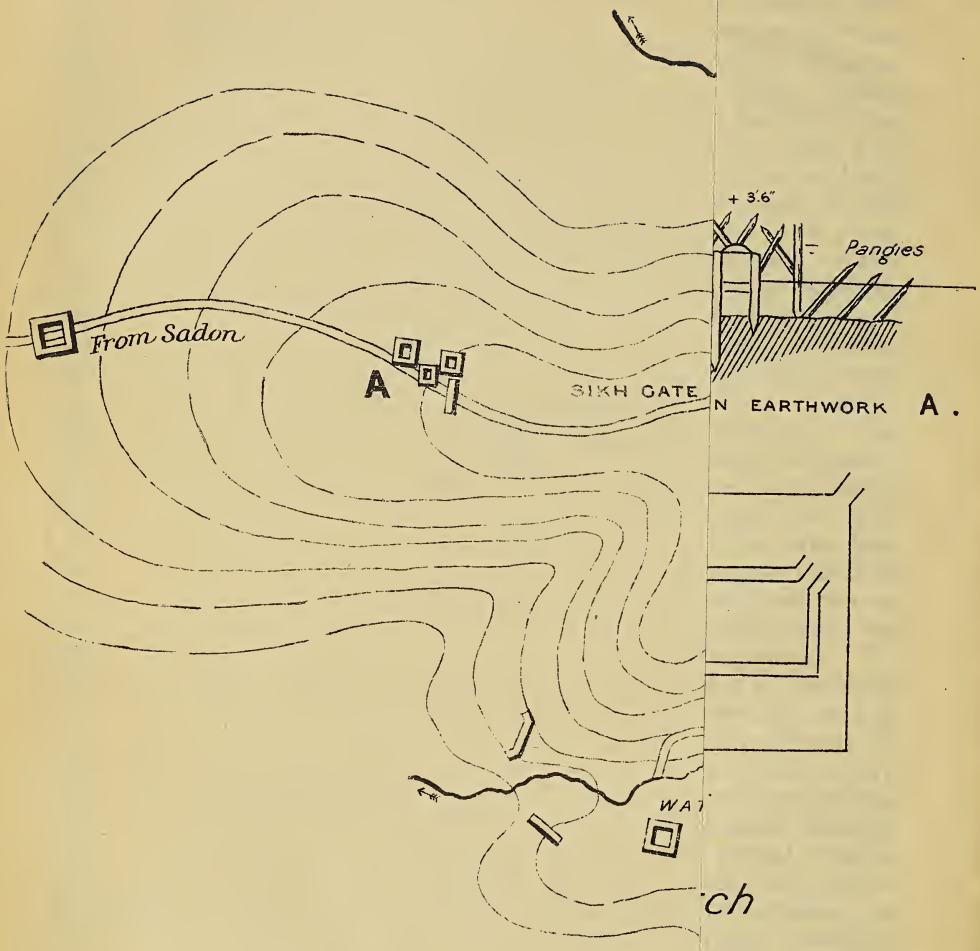

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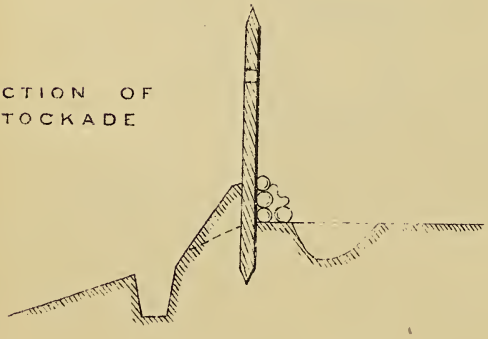
SECTION OF STOCKADE



r Plan.

100 200 YARDS

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as we got near the stockade the Kachins got nervous and fired at us, by mistake we emerged just in front instead of just behind the stockade, but jumped on the top and found about 15 of them inside. They fired in the air up at us, and I got off the six barrels of my revolver, hitting two of them, as they scuttled off. I then bound up the Jemadar and put him on a pony, and, having destroyed the stockade sufficiently to allow the convoy to pass, we hurried on. 600 yards ahead a large stone stockade with a ditch appeared, and the Kachins fired at us. We rushed it in front while they fired two ineffective volleys, and as we got to the stockade they bolted out; after this we hurried on towards Sadon, the friendly Kachins firing at us the whole way. On arriving at the river some 1200 yards below the Fort of Sadon we found that the bridge, the pride of Lieutenant Harrison's heart, had been destroyed and the ford blocked with boughs and spikes, while a hot fire was opened upon us. We struggled across a ford below the bridge, which was very deep and rocky, while the enemy amused themselves by firing at us from the jungles round, luckily, owing probably to the darkness, hitting no one. I hurried my weary men up the hill path, which was blocked with boughs and pangies (spikes made of bamboo), and arrived in the village of Sadon, some 1400 feet above the river. Here we all took courage, knowing that the fort was only 600 feet higher up, but hardly had we got fairly into the village when from every house the Kachin muskets flashed in the darkness; the mounted infantry ponies broke loose from the files leading them and the mule drivers left their mules, who promptly scattered in every direction. A mule driver was shot through the leg, and my Arab was also wounded. Mounting the wounded man on a pony, I hastened my party on through the village but could not collect more than three mules, and as our ammunition had come to an end it was useless trying to recover the others. The Kachins followed us up to within some 600 yards of the fort; here I halted, and we gave a cheer, which, to our intense relief, was answered by bugles sounding the "Advance" and "Assembly" inside the fort, and in another five minutes we were inside, no men being lost, though all my own and my men's kits were on the lost mules, as well as eight kegs of rum. We were enthusiastically received by the garrison, who never expected us to get through. Lieutenant Harrison, whom I knew well the other side of India, had no idea I was in Burmah at all, and was tremendously surprised to see me come in. My loss was—self and two men slightly wounded, native officer severely, one horse killed, my own wounded.

Now to resume the diary of the siege.

February 10th.—The enemy fired incessantly all the night, occasionally replied to by the sentries in the fort. My party and I were quite fit after our long march of 23 miles from H. Pong, of which 18 had been on foot and 17 under constant fire. The jemadar's wound was a severe one, the bullet having broken a rib and penetrated the right lung, the rest of our wounds were not serious. The enemy kept up a fire all day from the Scintong and Sadon sides; the garrison stayed inside and improved their defences with logs and stones, etc.

February 11th.—At 3 a.m. we were turned out by a tremendous fire and sound of beating gongs on the Scintong and Sadon far sides of the fort, and the Kachins made a determined assault, actually getting up to the Ghoorka gate and pulling out some of the pangies. We beat them off with hand grenades and rifle fire. Their advance was aided by old nullahs and large rocks, which enabled them to get within 20 or 30 yards of the post under cover. They drew off about 5 a.m. dragging their dead and wounded with them, as we only saw marks of blood when the day dawned ; our loss, one sapper severely wounded, one sapper slightly wounded. Supply of water finished.

February 12th.—At 9 a.m. we sallied out for water. Lieutenant Harrison decided to try the spring 400 yards distant, where the enemy had only two stockades, instead of the nearer but more dangerous one from which water had been obtained on the 9th. A party of Ghoorkas, supported by some of the 3rd Burmah, turned the Kachins out without loss to ourselves, though several Kachins were bagged. Water for four days was secured, and reservoirs made by burying water-proof sheets. In the afternoon Lieutenant Harrison and myself constructed bombs out of empty jam and milk tins, with a gun-cotton primer inside, packed with stones and sand, and a 10-second Bickford's fuze attached. We did this because our hand grenades were finished.

February 13th.—Enemy fired all day and all last night ; we could hear them working in the jungle building stockades, and could see them stockading Sadon village below us. Last night we persuaded three Panthays to try and take notes to Myitkyina ; we let them out at dusk.

February 14th.—On waking up we found that the Kachins had established themselves on a rock 150 yards from the post, and were raking the whole post with their fire. We resolved to have them out of it, and Lieutenant Harrison and myself emerged with 20 Ghoorkas and 20 Sikhs of 3rd Burmah. After half-an-hour's sharp fighting we turned them out, and found that their position behind the rock was supported by three square earthworks, whose parapets were about four feet high and two feet thick, rivetted on either side with bamboos, the whole loopholed and surrounded with high spiked fencing, and the ground round stuck with pangies. One of our men trod on a pangie and it went through the sole of his boot and his foot and came out at the top. Our loss was one sepoy shot through the thigh, and four slightly wounded. We destroyed the enemy's works and burnt the fencing, bringing several bundles of neatly-made fascines into the post.

February 15th.—Messengers arrived from the North-Eastern Column, which had arrived within 40 miles of Sadon, to ask if Major Yule wanted any co-operation. We sent back word of the position we were in.

February 17th.—Enemy firing at regular intervals through day and night. We tried to make rockets to signal Myitkyina, but without success. Yesterday we captured arrows with coils of sulphur round them, evidently for setting our roofs on fire. To-day two of these

alight fell into the fort; precautions against fire were increased. During last night the enemy unmasked a strong stockade about 200 yards from the post near Scintong. We at once constructed emplacement for the machine gun to fire at it.

February 18th.—To-day the North-Eastern Column heliograph was seen "tempestuously at play" on hills some 20 miles off. We tried to reply with looking-glass. This morning I constructed a gun out of bamboo, bound at muzzle and breech with wire, then covered with splints of wood, and the whole bound round with cord, length of bore two feet, calibre, three inches. The shells, six inches long of bamboo, cut off at the joint, filled with 1 oz. powder, stopped with mud, and 10-second Bickford fuze stuck in it. We fired five rounds from it with 1½ oz. R.L.G. charge. The fuze was lit, shell rammed home, and gun fired by a train immediately; shells went about 300 yards and burst, two of them in the air. The Kachins evidently impressed. We observed them digging what appeared to be a sap, protected by breastworks, some 180 yards off; shot two of them while at work.

February 19th.—Enemy fired all night as usual; two bullets came through the shelter in which we messed. About 4 p.m. we heard firing, and saw the North-Eastern Column skirmishing down the side of the opposite hill, and pitch their camp about six miles off. They signalled that they would start at 7 a.m., and told us that if Scintong fired on them while they attacked Sadon we were to attack Scintong.

February 20th.—While going rounds at night we heard shots, and saw, to our great delight, a blaze of musketry from the North-Eastern camp and knew that the Kachins had "drawn" them. At 7 a.m. the North-Eastern Column advanced, and began to shell Sadon at about 2000 yards. They continued shelling from 10 till 11 o'clock, and their infantry halted about a mile below Sadon. The garrison got tired of waiting so Lieutenant Harrison and I with 20 Ghoorkas, 20 3rd Burmah, and 20 Sappers sallied out against Scintong. Here we had about 40 minutes sharp fighting, and found the place heavily stockaded from house to house, but the Kachins did not make a very determined stand, and we fought our way through the village, the Sappers cutting down barricade after barricade made of spiked fences set double about three feet apart, and rows and rows of pangies in front, with earthworks behind; our loss five wounded. We saw four Kachin bodies, but must have wounded many more. In the meantime the North-Eastern Column had succeeded in frightening the Kachins out of Sadon by their long range fire, and when the infantry entered the village they found line after line of almost impassable stockades, heavily pangied and spiked. If they had come on and kept the guns up their sleeve till the road was blocked by stockades and they could not pass them, and then opened fire with the guns, they would have had fighting to their hearts' content. But Kachins will not stand long range artillery fire, rifle fire they do not mind a bit; so the North-Eastern Column marched in unopposed, though the Kachins made for their rear-guard and wounded two severely and three slightly, and captured one follower. The North-Eastern Column consisted of 253 rifles and two

guns No. 6 Mountain Battery (Bombay), under Lieutenant Baldwin, R.A. Their rear-guard came in about 5 p.m., and the whole camped round the fort. Thus ended the siege of Sadon, in which the garrison had been under arms and in the trenches of the post for 14 days and 13 nights, and lost four men killed and 29 wounded, including one British and two native officers. Two of the wounded subsequently died of their wounds.

On afternoon of the 20th, 100 rifles visited a neighbouring village from which the Kachins fired on us; the village was burnt. About 600 yards from the fort a tremendously strong stockade was found blocking the road to the village, it consisted of two earthwork block-houses, surrounded with rows of pangies and double-spiked fences six feet high, it was, however, empty.

On 21st some 200 rifles and two guns visited neighbouring villages, and had several skirmishes; our loss, one corporal of the Devons severely wounded. The heliograph was seen from the Irrawady Column on hills some 20 miles off. This was answered, to their surprise, with the North-Eastern Column helio. They first inquired if I had arrived, as I had been reported destroyed, and then innocently asked if there had been any fighting, and if we had had any wounded. Our reply astonished them.

The Irrawady Column arrived on 22nd, and after resting till 26th started off to the Chinese frontier. The enemy could be seen by a telescope from the post very busy stockading the road to Namliku, a village some seven miles off on the road to the frontier. Accordingly at 4 a.m. Lieutenant Drever and 60 Ghoorkas Mogany Levy started off to get behind the enemy's works in the dark, with orders to lie concealed. This they managed to do, and got close enough to hear the Kachins working and talking. At 7 a.m. the column started, and engaged the enemy about 8.30 a.m. Fire was opened from two mountain guns, and the infantry extended and advanced in front of the enemy's works. The Kachins kept up a constant fire, but a shell bursting close up to a stockade destroyed their confidence, and they retired from the unequal contest only to fall into the hands of the bloodthirsty Ghoorkas, who killed eight and fired away a lot of ammunition, with what effect is not known, as the Ghoorka military policeman is a terribly bad shot. Our loss was one man severely, and four slightly wounded. Kachin loss estimated at 12 killed and 30 wounded. Kachins numbers, about 200; our own, about 180 rifles and two guns. Our troops captured 14 stockades, in front of some were pits full of spikes covered with grass and earth. The column after staying out five days returned, and has since been working the country round. On 5th March, General Stewart, Commanding in Burmah, and General Gosset, Commanding Mandalay District, arrived at Sadon and inspected the enemy's works, etc. On 11th of March part of the column is to start out to visit Lakapyang, some 30 miles away, and on returning will remain at Sadon till the middle of April, when the post will be handed over to 250 rifles of the Ghoorka Mogany Levy. No more fighting is expected as the Kachins are coming in and ask for pardon, saying "We have made a mistake and had no idea

you were so strong, it shan't occur again." They say that the garrison of Sadon killed and wounded sixty of them during the siege, but this is certain to be under-stated by them.

The total loss during the expedition was :—

Irrawady Column—8 killed, missing, and died of wounds; 41 wounded. Out of which the Sadon garrison lost 8 killed, etc., and 27 wounded.
The North-Eastern Column at Sadon lost 1 missing, 6 wounded.
Total casualties, 56.

The Kachins were armed with matchlocks and Tower muskets, and a few rifles, probably Sniders. A matchlock will carry a good 500 yards. They also brought a jingal to attack the fort with, and smashed one post in the stockade by a successful round. The ammunition for this was, however, scarce, as they fired about one ball to every four blank.

This expedition has had more fighting than there has ever been in any one district in Burmah, the casualties from wounds, etc., being about 14 per cent. not counting sickness, and it is to be hoped that the Kachins have learnt a useful lesson. The Sadon post will be a very important one, as it is on one of the principal trade routes from China.

The Kachins state that 50 Chinese helped in and directed their operations against us.

FIELD ARTILLERY FIRE.

BY

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CHAPTER IX.

The Examination of Range Reports.

In the preparation of a range report the very greatest care should be taken that the fullest and most accurate information is recorded, and too much attention to accuracy of observation cannot be paid by the range party. For it is by a careful study of the range report that we get a vast amount of information regarding the laying and setting of fuzes of the battery and are able to deduce the mean errors of our guns and the average variation in the ranging of the projectiles and the burning of the fuzes.

Let us take the most important point first, viz., the checking of the laying of the battery by the results actually obtained and recorded by the range party.

The annexed example is taken from a battery practice report of 1890, and is an excellent example of the value of this kind of analysis.

No. of round.	No. of gun.	Elevation.	Result as judged by range party.		Range of target as calculated from each round.	Each round referred to the relative range: 2045·7 yards.	
1	2	3	4	5	6	7	8
			−	+		−	+
		Yards.	Yards.	Yards.	Yards.		
1	1	2000	40	—	2040	—	5·7
2	2	2200	—	180	2020	—	25·7
3	3	2100	—	160	[1940]	—	[105·7]
4	4	2050	20	—	2070	24·3	—
5	1	2075	5	—	2080	34·3	—
6	2	—	—	10	2065	19·3	—
7	3	—	—	100	[1975]	—	[70·7]
8	4	—	Premature.		—	—	—
9	1	—	—	35	2040	—	5·7
10	2	2050	—	25	2025	—	20·7
11	3	—	—	80	[1970]	—	[75·7]
12	4	—	Range.		2050	4·3	—
13	1	2025	25	—	2050	4·3	—
14	2	—	—	8	2017	—	28·7
					2045·7	86·5	86·5

The first five columns are taken direct from the range report, the sixth column is arrived at as follows :—

The first round was fired at an elevation of 2000 yards and it fell 40 yards short of the target, the inference is then, at least as far as No. 1 gun is concerned, that the target is 2040 yards distant from it. Each round is treated in a similar manner.

This sixth column must now be carefully examined for badly laid rounds, and these can be detected and eliminated as follows :—

On reference to the range table it appears that 50 per cent. of the rounds at this range should fall within a rectangle 21 yards in length, and therefore all the rounds should fall within a rectangle of 84 yards. Now, if we carefully examine column six we shall see that a rectangle of 84 yards will include all the rounds with the exception of three, viz., rounds 3, 7 and 11, which all went considerably over the target. These rounds, moreover, were all from the same gun, No. 3, the laying of which requires seeing to, but, as will be shown presently, the laying of this gun is very uniform, and the fault most probably lies in the Scott's sight being out of adjustment.

Let us then eliminate these three rounds from the calculation and mark them by putting them in brackets. The remaining distances in the column are then added together and divided by the number of rounds remaining in the calculation. The result is, therefore, the relative or shooting range for the whole battery, less No. 3 gun, and will show us how near the Battery Commander really got to the target by the ranging process. In this case he accepted the range as 2025 yards. The actual relative range, viz., 2045·7 yards, should be compared with the range as given by the range-finder, and the difference between the two is the error of the day.

Having got the relative range we can now reduce the laying of the guns to a common elevation, thus :—

Round 1 was fired with an elevation of 2000 yards and was 40 yards short; if it had been fired with 2045·7 yards elevation it would have gone 45·7 yards further, and thus have been 5·7 yards over instead of 40 yards short. Each round is referred in a similar manner to the elevation 2045·7 yards and the results recorded in columns 7 and 8. The result shown by these columns is as if a large group of 14 rounds had been fired with the elevation 2045·7 yards, and, if we have calculated the relative range correctly, the sums of the two columns should be equal. If the sums of the two columns be added together and divided by the number of rounds we shall get the mean error of the shooting of the battery, omitting the rounds fired by No. 3 gun; thus $86{\cdot}5 + 86{\cdot}5 \div 10 = 17{\cdot}3$ yards, the mean error, which, multiplied by 1·67, will give us the 50 per cent. rectangle of the battery. This latter should be compared with the 50 per cent. rectangle given in the range-table, but it must not be expected that the 50 per cent. rectangle of a whole battery can ever be as small as that of a single gun. A well-trained battery should not show a greater mean error than 30 yards for common shell and 20 yards for shrapnel shell, the latter being much the most accurate projectile.

The mean error of each layer may be determined in like manner,

and this proceeding is invaluable in classifying the layers. Errors in Scott's sights may be detected in like manner.

In studying the performance of No. 3 gun it will be seen that all three rounds fell within a space of 35 yards, which shows uniformity of laying; in this case only exceeded by the laying of No. 4 gun, whose two rounds fell within a space of 20 yards, it is, therefore, most probable that the Scott's sight of No. 3 gun required adjustment, and this should be seen to before the gun-layer is accused of inaccuracy.

Another great advantage of this system of analysis is that it can be proved beyond reasonable doubt what guns are badly laid; very often in looking over a gun at elementary practice a correction is ordered in the laying, about which the gun-layer, although acquiescent, is not convinced of the accuracy and would rather trust to his own laying, but by the above method of proof conviction must follow.

We now turn to the practice with shrapnel for which a different example is taken. The results are not quite so reliable as those of common shell on account of the greater difficulty of judging the exact position of the burst of the shell. Officers must exercise their own judgment in accepting the height of burst as given either by the battery or by the range party; that of the former is generally most accurate when the measurement is made with a Scott's sight, on other occasions it is best to take the mean of the two observations, unless one of the two can be discarded as obviously incorrect.

The data required can all be obtained from the practice report and the angle of descent from the range table.

No. of round.	Elevation.	Length of fuze.	Height of burst.	Burst or 1st graze of shell.		Where the shell would have fallen if it had not burst in the air.	
1	2	3	4	5	6	7	8
				−	+	−	+
	Yards.		Feet.	Yards.	Yards.	Yards.	Yards.
7	1270	6·5	G.	40	—	40	—
8	—	6	20	200	—	10	—
9	—	6	20	150	—	—	40
10	—	6	25	140	—	—	91
11	—	6·25	15	120	—	—	2
12	—	6·25	10	100	—	5	—
13	—	6·25	10	40	—	—	55
14	—	6·25	10	100	—	5	—
15	—	6·25	8	60	—	—	5

Angle of descent 1 in 28·5.

The way columns 7 and 8 are arrived at is as follows:—

Round 8 burst 200 yards short of the target and 20 feet up in the air; now if it had not burst it would have travelled, with an angle of descent of 1 in 28·5, 190 yards before it touched the ground, that is to say it would have been 10 yards short of the target. All the rounds are worked out in a similar manner, and from inspection it can be seen which rounds were badly laid; in the above example round No. 10 was badly laid. If desired, the relative range of the shrapnel can also be worked out and compared with that of the common for the same elevation. Columns 7 and 8 of the above give the relative range as 1263 yards.

Still further information may be got from the above, namely, as to the fuze setting of the battery, for this purpose, however, there should be at least four fuzes of the same length to calculate from. In the above case rounds 11 to 15 give a good example. If the distances that these shell burst short of the target be added together and divided by the number of rounds, viz., 5, this will give us the mean point of burst of the group of shell, namely, 84 yards short of the target; each individual burst must now be referred to the mean point. Thus round 11 was 120 yards short, or 36 yards on the battery side of the mean point of burst, the results are tabulated thus:—

No. of rounds.	Distance of burst from mean point of burst. 84 yards short.	
	—	+
	Yards.	Yards.
11	36	—
12	16	—
13	—	44
14	16	—
15	—	24
Total ...	68	68

As in the case of the relative range, if the two sums be added together and divided by the number of rounds it will give us the mean error of the fuzes; in the above case $68 + 68 \div 5 = 27$ yards.

From working out many hundreds of rounds with the 12-pr. the writer has found that at average service ranges, from say 1800 to 3200 yards, the mean error of the fuzes set by a well instructed battery is on the average about 19 yards. In the above case this has been exceeded, and it may be said that the setting of the fuzes of rounds 11 and 13 might have been better.

Mean errors of fuzes taken from the practice reports of a well-trained battery:—

Range.	Number of fuzes calculated from.	Mean error of fuze.
Yards.		Yards.
600 to 1000	32	18
1000 to 2000	105	19·7
2000 to 3000	116	19·5

CHAPTER X.

Drill and Instruction.

The great object of drill is, as stated in a previous Chapter, to ensure a strict discipline under fire by teaching the men to perform their duties almost mechanically, even under the stress of extreme excitement.

But purely mechanical drill is of all things most wearisome and most likely to disgust a recruit with his chosen profession. Such drill then should be avoided as much as possible, and, as some of it is indispensable, administered in the smallest possible doses at a time. Some officers can remember the time when hours were spent in throwing the sponge backwards and forwards over the gun and in the Nos. 2 stepping up to sponge out, in order that all the battery might work exactly together. All this is a thing of the past, nor is there time, in the face of more pressing demands, to attain the standard of mechanical precision of the long service soldier.

Everything should be done to make the drill as interesting as possible, and, by a constant change of duties, to keep the men's attention fixed. Drill should be alternated with short lectures, which, in order to make them attractive, should be delivered *extempore* and illustrated by examples. Officers will find it a very useful thing, not only as a means for their own education, but also for rivetting the attention of their men during lectures, if they would keep a common place book, in which to jot down little stories which they may hear or pick up in newspapers or in general reading, especially in reading narratives of personal adventures in great campaigns, in which minor details are more often mentioned. The writer has kept such a book for some five years, and ventures to think that there is hardly anything which it is important that the men should remember that he cannot illustrate by some anecdote to the point. For instance, a gun-layer is observed to leave his sight in the gun when firing; in addition to drawing his attention to it, tell the detachment the story related by Prince Kraft of how the C.O. of a battery found the shell of his battery falling shorter and shorter as fire continued; he afterwards found that the sights, which were then left clamped in the gun when firing, slipped down a little with each round, a fact which escaped notice in

the excitement of the fight. Such a story not only corrects the fault, but impresses the duty on the memory and commends itself to the intelligence more than a bald order, the reason for which may not always be apparent.

Again, nothing is so wearisome and so unlike what would occur in the field as laying on a chalk mark on a blank wall. Service objects should always, when possible, be selected, and a regular story connected with each, thus, instead of merely telling a man to lay on a certain hedge, all the gun-layers should be called together and the hedge pointed out to them as actually screening an enemy and the whole business of the selection of a ranging point, of the ranging process and of the distribution of fire should be gone through. Houses may sometimes be selected in order to practice the layers in distribution of fire in height, and woods for practice of distribution in depth. To further engage their attention the Battery Commander should himself not know the range and length of fuze for the target, but this should be thought of by some other person, *e.g.*, the Sergeant-Major, who, having decided on the range in his own mind, will tell the Battery Commander after every round what the result of the round was; the latter thus gets good practice in the routine of the ranging process, and will soon find that he can range his battery accurately and quickly without the aid of pencil and paper, he will thus be enabled to concentrate his attention more on the observation of fire. If the result of each round is called out by this second person sufficiently loud for the gun-layers to hear, it will soon teach them what the principles of the ranging process are, they will thus be enabled to give intelligent assistance to the C.O.

If it is impossible to select service objects from the barrack-square something may be done with the instructional target, which should be placed so that the central line is horizontal, the lower half of the target is then said to represent a hillside, half-a-dozen dots, some four inches apart, are made along the line, which represent the muzzles of six guns firing over the crest, a horizontal stroke half way down the hill represents the enemy's main infantry position in shelter-trenches, and a few strokes near the top may represent a village upon which one of the enemy's flanks is resting. By these means distribution of fire and changes of target may be practised, and it is possible to arouse a certain amount of interest in the drill. If a small blank wall is available and any officer is acquainted with the art of scene painting, even of the roughest, actions may be fought over every species of country in the course of a few weeks. The officers of some batteries have prepared small targets representing various bodies of troops of different arms, these placed 30 to 50 yards from a battery on the barrack-square represent service targets at various ranges and are invaluable for instruction in laying and in the application of fire to different formations. Of course this barrack-square instruction is in addition to that given in the open field, but the method will be found to advance the education of the recruit much more rapidly than the old system of standing gun-drill practised *usque ad nauseam*.

In doing this battery gun-drill too much attention should not be

paid at first to minor lapses of drill, the proper methods will grow imperceptibly upon the men, indeed, they seem to teach themselves, and it destroys the semblance of real action if too frequent pauses are made to correct small mistakes in positions, etc. Ten minutes rigid standing gun-drill per parade should be ample.

Changing rounds.—Some such process is required in order that every man may be fully instructed in all the duties at the gun, and in order to prevent the continuous performance of the same duty by the same man becoming tedious, but the mechanical changing rounds is not a service condition and the same result may be obtained in a more practical manner by other means. In action no one would think of changing rounds, but numbers are replaced as casualties occur. The system then of making casualties at drill should be pursued, this will keep the spare numbers constantly on the alert. The gun-layers should most frequently be declared disabled, in order that this most important function may be well practised by all and to see that the other numbers have, as occasion offers, made themselves acquainted with the target, so that the fire may be continued regularly without intermission and in spite of losses. As No. 2 is most likely to know the target, as he, by traversing, helps the gun-layer to lay, he should be, and is, first called upon to take the place of a layer disabled, for this reason he should be the second best layer in the sub-division. By giving casualties instead of changing rounds pauses in drill are, or should be, avoided, and men are taught in peace what they must expect in war.

On the word of command "Prepare for.....".—One great source of delay in turning fire from one target to another is that it is not thoroughly understood, when this word of command is given with reference to common shell, case shot, or percussion shrapnel, that the loading should actually take place without any further word of command.

For instance, a battery is firing time shrapnel at a target and another target at a greater range is pointed out to it. It would be of no use turning the time shrapnel on to the new target, unless circumstances were pressing, as they would all burst far too short, but the Battery Commander gives the word, "Prepare for Shell." This means that as the guns loaded with shrapnel are fired in due rotation they shall be reloaded with common shell; while the fire is going round the battery the new target may be pointed out, and when the turn comes to the first gun loaded with common shell the word "Slow Fire" is given. If it is desired to turn the fire rapidly on the new target the rate of fire for the remaining rounds of shrapnel may be increased, thus: "Rapid fire from the Right (or Left) of Sections, and Prepare for Shell."

In the event of the new target being nearer than the old the fire may be turned off at once for, the time fuzes being long for the new range, the shrapnel will act on graze; in this case it would be advisable to continue the ranging with percussion shrapnel, or rather with time shrapnel with the time safety pin not withdrawn. The only word of command that is necessary to turn on to the new target is, after one blast of the whistle, "Target so-and-so. Slow fire."

Whenever case shot is ordered the fire is ALWAYS turned on to

the new target at once; thus, a battery is firing time shrapnel at a target 2800 yards distant, suddenly a cavalry target appears on its right flank about 1200 yards off and coming towards it, the word of command would be "Cavalry right; 800 yards; Rapid fire from the Right (or Left) of Sections; Prepare for case." In the above order the distance 800 yards was given in order to allow time for the guns to be laid on the new target, and for the shrapnel to have a useful effect.

In both the above cases the order "Prepare for....." is complete and no further order is necessary before loading may take place, but in the case of time shrapnel a further order is necessary, namely, the length of fuze, so in this case, "Prepare for Shrapnel" (unless it is percussion shrapnel, when the order is complete) means that the shrapnel are only to be brought up to the guns, but the latter are not loaded until the order is completed by the length of fuze being given.

Instruction.—In instructing the recruit on the subject of the *matériel* with which he has to deal none but the most practical details should be impressed upon him, such as the weight and total length of his gun and carriage, track of wheels, smallest passage through which it can pass, number of pairs of wheels that can be placed upon a railway truck, and such like details that may be of practical use every day; internal dimensions, nominal lengths, etc., are an unpractical burdening of the memory. Instruction in *matériel* should take the practical form of taking to pieces and putting together everything about the gun, except Scott's sights, and in the packing of limbers and wagons, every man in the battery should be as perfect in this respect as a good limber-gunner.

With regard to instruction in ammunition, manufacturing details should never be taught. Information on such points is learnt willingly or gradually absorbed, by those minds fitted to receive it, and every facility and assistance should be given them to acquire it, to attempt to force it on others is waste of time and an unprofitable labour.

With regard to theoretical instruction in gunnery, it appears to me that it should not be forced upon minds unfitted to receive it. In the infantry, each man being personally responsible for the shooting of his weapon, a certain amount of such knowledge is desirable, but with us there is no such great necessity that all should have an intimate acquaintance with the theory of flight, etc. The non-commissioned officers should, of course, have a good theoretical knowledge proportionate to their rank.

Very much may be done in the way of instruction in the lecture-room and officers should remember that most men, especially recruits, take in ideas more readily by the eye than by the ear. It is important then to make as much use as possible of the blackboard and chalk; and therein, and in giving the description *extempore*, lies the secret of success in lecturing.

A few simple ideas enunciated slowly, while looking straight at the audience and copiously illustrated on the board, are more telling than the cleverest of papers, however well read. The reader, with his eyes on his paper, fails to hold the audience with his eye and, the head being naturally bent so as to be able to read, the voice is directed

rather downwards on to the desk than forward into the room, and thus loses much of its power of compelling the attention.

Lectures to recruits should never be long, quarter-of-an-hour to twenty minutes at the outside, and half-an-hour for non-commissioned officers, is quite as long as their minds can be kept on the stretch for the reception of new ideas. The lecture should be immediately followed by a close catechising to make sure that every point has been properly set before them in language that they can understand.

CHAPTER XI.

Foreign Artilleries.

It would be impossible within the limits of this work, as well as useless to the great majority of readers, to attempt to fully describe all the Field Artillery of Foreign Powers; only the most useful information, therefore, is given, and those points where the equipment shows that foreign opinions are at variance with our own. The principle points of interest are given in the table on page 401.

Nomenclature.

It will be noted that calibres, from which the guns are called, are given in centimetres, except those of the French guns, which are given in millimetres. The French guns are actually of 80 and 90 millimetres respectively, the others vary, in the case of the 9 cm guns, from 85 to 87 millimetres, and are called 9 cm on the same principle that our 12½-pr. is called a 12-pr.

Breech Action.

With the exception of the French and ourselves, who use the interrupted screw breech block and the Du Bange system of obturation, other nations have adopted the Krupp cylindro-prismatic wedge, or a modification of it, with the Broadwell ring obturator; a most excellent form of breech action, simple and strong, though, like our own, not perfectly immaculate in respect of jamming and minor accidents, which, however, when they do occur, are not vaunted abroad; for it never does to make a man mistrust his weapon.

Calibre.

It will be seen that the majority of the Powers have adopted a gun of the same calibre for both Horse and Field Artillery, which cannot fail to simplify the supply of ammunition from the Reserves. The Austrians have, I believe, recently adopted a 9 cm gun for their Horse Artillery instead of the 8 cm gun shown in the table p. 401.

Weight Behind the Team.

Horse Artillery.—This most important factor in Horse Artillery equipment is worthy of study. Horse Artillerymen are practically unanimous in saying that the weight behind the team should not exceed 6 cwt. per horse, some place it as low as 5½, and it will be seen that all nations admit the truth of this dictum and legislate accordingly, except ourselves, who, in addition to having 37½ cwt. behind the team, put two gunners on the limber, which practically brings the weight up to 41 cwt. This, however, is in a fair way to be remedied by the introduction of a lighter 12-pr. Horse Artillery gun, expressly designed for the use of smokeless powder and by taking the two men off the limber. Meanwhile the Cavalry Manœuvres in Berkshire in 1890 have left as a record the impossibility of dragging 41 cwt. behind the team in the Horse Artillery.

What is the reason why our equipment should so much exceed the others, seeing that we have not a heavier shell nor do we carry more rounds than the others? The great muzzle velocity, which enjoins powerful and heavy breaks and a comparatively strong and heavy carriage to absorb and control the shock of discharge, otherwise the recoil would be excessive and the carriage soon shaken to pieces.

Field Artillery.—The weights behind the team are all much alike, some 38 cwt. plus five men, with the exception of the French, who have a weight of 41 cwt. plus five men (according to one authority three men, but five is probably correct, as three could hardly work so weighty a piece). It is an openly expressed opinion of the French Artillery Officers that their gun is too heavy for Field Artillery and that, with their short service drivers, the men do not drive well enough to drive the leaders of a team of four pairs, which they ought to have for the weight behind them. The reason for the great weight of the French equipment is that, although they have the heaviest shell they have also the highest velocity, except ourselves, who in accepting the high velocity have had to content ourselves with the lightest projectile of all. With this light projectile we certainly carry a few more rounds than other Powers, but the total weight of ammunition per gun and limber carried by us is less than that carried by other Powers on account of the comparatively great weight of the rest of the equipment, brought about by the high velocity.

Heavy Field Artillery.—It is accepted abroad that 45 cwt. is not an excessive weight behind the teams for heavy field or light position guns; this, I presume, means that the detachments will mostly be on foot except on good roads, and the guns will manœuvre but little, and not often move at a trot off the roads.

There are only two examples to offer, of which one, our own, is still in the experimental stage.

There is some talk of re-introducing the 95^{mm} gun into the French service to the extent of one battery per Army Corps, for the express purpose of firing shell loaded with a high explosive.

Special.—Of this class only one claims attention as actually being a service weapon of which details are known, namely, the Russian 6-inch

field mortar. Other Powers are experimenting with weapons which approximate nearly to the 12·5 centimetre field howitzer of the Swiss service.

These weapons are meant to compete with the tendency, now becoming so marked under the deadly effect of modern firearms, to make great use of the spade in warfare, and this beyond the mere breastwork and shelter-trench of the past.

One of the most striking features of modern-type field works is the completeness of the overhead cover in the shape of field casemates that has been designed for them. In this cover it is proposed that the infantry shall shelter until the artillery combat is over, and, still concealed there, they hope to survive the preparation of the infantry attack by the opposing artillery and only to issue therefrom when the attacking infantry advance to the assault and the heaviest part of the supporting artillery must perforce cease, at least for a time.

To try and neutralise the work of the spade, weapons for high-angle fire have been designed, how far they will succeed in their mission time alone will show. Should a reliable high explosive be used with their common shell it could not fail to have a great effect on any work that it is possible to construct in the field.

Organisation.

All the batteries that come under our notice are each of six guns, except the Austrian and Russian field batteries, which are each of eight.

There are three factors that influence the choice of numbers: expense, mobility, and fire effect, and, to thoroughly appreciate the value of each, we must study how each affects the organisation of 4, 6, and 8-gun batteries, for into one of these three organisations have guns always been collected since the assemblage of the old galloper and battalion guns into batteries.

Expense.—It is manifest that, of the three, the 8-gun organisation is the cheapest. For, if 24 guns be taken (the L.C.M. of 4, 6, and 8) in 4-gun batteries they will require the staff of six batteries, whereas with 8-gun batteries only the staff for three is required, hence a great saving in pay, officers, staff N.-C.O.'s, forges and horses, a matter of great consideration for a country that, not being rich, has to maintain the gigantic armaments of the present day.

Mobility.—Here the 4-gun battery has, without doubt, a great advantage, but the expense of its establishment and a disadvantage as to its fire effect preclude its use, even for Horse Artillery, where its mobility is most desirable. The 8-gun battery, while sufficiently mobile for Field Artillery is not so for Horse Artillery, so, although Austria and Russia have adopted the 8-gun organisation for their field batteries, they have been obliged to limit their Horse Artillery batteries to six pieces.

The Russian field mortar batteries are also of six pieces for the reason that if of eight the number of vehicles for the conveyance of its heavy ammunition would be too great for one battery.

Fire Effect.—This, in conjunction with mobility, is naturally the most important factor to consider, and the soldier would gladly set the question of expense on one side altogether.

It is found, as a matter of practical experience in action, that with a 4-gun battery there are pauses in the fire after every four rounds, that is that the battery cannot keep up the regular and continuous fire so sought after in the field. Irregular fire leads to hurry and confusion, and thus a 4-gun battery lacks an essential quality that a battery should have, viz., good fire effect.

With an 8-gun battery it is generally found that there are two guns loaded and waiting for their turn to fire, consequently wasting time.

With a 6-gun battery, which presents the just mean, there are no pauses, and every gun is doing its full work without hurry and without waste of time.

Moreover, a 6-gun battery can range itself in just the same time as an 8-gun battery, because the guns cannot be fired quicker than the rounds can be observed and corrections made, consequently a 6-gun battery is at no disadvantage in this respect.

An Austrian writer has lately been animadverting against their 8-gun organisations, says he, "If three six-gun batteries engage three 8-gun batteries they will range in equal times, and it is found practically that 8-gun batteries fire no greater number of rounds per minute than do 6-gun batteries, therefore the 18 guns can engage the 24 upon equal terms. Now, if 24 guns in 6-gun organisations engage 24 guns in 8-gun organisations the former are practically six guns to the good and should, by the concentration of fire of two batteries upon one, rapidly gain the upper hand." He, therefore, strongly recommends the adoption of the 6-gun organisation.

With respect to the rate of fire from 8-gun batteries it is worthy of notice that the Russian batteries fire very slowly; their "very rapid" fire being only at the rate of three rounds per minute.

Amount of Ammunition Carried with the Battery.

It will be observed that we are much behind other Powers in this respect. This is accounted for by their having 8, 9, 12 and, in the case of the Russian heavy field batteries, 16 ammunition wagons per battery.

It should be remembered that the totals of the Austrian and Russian field batteries must be divided by 8, in order to show the common base of comparison, the number of rounds per gun.

Draught.

All nations, except ourselves, employ pole-draught for both guns and wagons.

Ammunition.

The main points of difference between foreign ammunition and our own have been touched on in preceding chapters.

HORSE ARTILLERY.

Country.	Ordnance.	Weight behind the team. Gun and carriage without detachment.	Men on gun and limber.	Weight of shrapnel shell.	Bullets in shrapnel shell.	M.V. — f.s.	No. of rounds. Gun and limber.	No. of rounds. Total per Battery.	Battery. No. of guns.	Battery. No. of wheeled vehicles.	Remarks.
		cwts.		lbs.							
England ...	12-pr. B.L.	37½	2	12½	177	1710	38	648	6	19	
Austria ...	8 cm	32	—	10½	105	1365	40	912	6	19	Recently changed to 9 cm.
France ...	80 mm	31½	—	13¾	162	1608	30	936	6	18	
Germany	9 cm	35½	—	17¾	262	1407	34	808	6	20	
Italy ...	7 cm	30½	—	9½	109	1416	44	906	6	17	
Russia ...	9 cm	32½	—	15	165	1350	23	780	6	30	

FIELD ARTILLERY.

Country.	Ordnance.	Weight behind the team. Gun and carriage without detachment.	Men on gun and limber.	Weight of shrapnel shell.	Bullets in shrapnel shell.	M.V. — f.s.	No. of rounds. Gun and limber.	No. of rounds. Total per Battery.	Battery. No. of guns.	Battery. No. of wheeled vehicles.	Remarks.
		cwts.		lbs.							
England ...	12-pr. B.L.	37½	5	12½	177	1710	38	648	6	19	
Austria ...	9 cm	38½	5	15¾	165	1440	32	1024	8	22	
Germany	9 cm	39	5	17¾	262	1407	34	808	6	19	
Italy ...	9 cm	38	5	15¼	176	1490	36	780	6	15	
Russia ...	9 cm	37¾	5	15	165	1450	30	1200	8	29	
France ...	90 mm	41	3 (5)	19	317	1492	27	846	6	18	Heavy.
England ...	20-pr. B.L.	45	—	20	280	1650	Experimental.				Heavy.
Russia ...	11 cm	42½	5	27½	340	1225	18	864	8	33	Heavy.
Russia*	6″ B.L. mortar.	38	—	62	610	902	12	—	6	36	Special.

*Common shell=46 lbs. Bursting charge=12½ lbs.

Corrected up to 1st August, 1891.

NOTES OF LECTURES

ON

ARTILLERY IN COAST DEFENCE.

BY

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(Instructor of Gunnery).

PART II.

Fire Tactics.

The second division of our subject is that of "Fire Tactics."

Under Organisation we treated of the preliminary arrangements which have to be made, in order that fire may be opened as speedily as possible at the desired objective; under this heading it is proposed to consider the answers to the questions; at what object should fire be opened? at what part of that object? and with what projectile?

As regards the first question it is obvious that to open fire indiscriminately at an enemy's vessels, each Fire Commander[1] selecting his own objective, would lead to confusion and loss of power. To obtain the greatest possible effect out of the guns, requires that their fire should be utilised with a definite aim in view, that aim being to defeat the object of the enemy, whatever that may be.

It is a principle of defensive fire tactics of universal application, that the most intense fire should, at every phase of an engagement, be directed on that part of the attacking force whose action, if successful, would most imperil the defence. In order to know what vessels of an attacking squadron it would be most necessary to direct our fire upon, we must therefore have some idea of what that squadron is likely to attempt, and in what manner they will make use of their vessels in order to accomplish their object.

Now a fleet may attack a coast fortress with a view to occupy the water area defended by it, temporarily, while a force is being landed or permanently, in order to use the harbour or anchorage as a naval base, or as a base of operations for an invading army. An army would, it is true, be probably landed at some undefended part of the coast, but unless a port in its neighbourhood were seized the operation

[1] Since the first part of these notes was printed, the designation of the Fort Commander has been altered to "Fire Commander;" and that of the Sub-Commander for discipline to "Group Commander."

of supplying that army with the necessaries of war would be very precarious.

Again, a fortress may be attacked with a view to destroying a dockyard or shipping sheltered behind its guns, and also for the purpose of seizing stores of coal, &c.

Lastly, the attack may be made simply with a view to the moral effect produced on the defenders, or to distract their attention from some other point of the coast line.

The method of attack will vary somewhat according as the fortress defends a roadstead open to the sea, or a channel giving access to a harbour or the mouth of a river.

If the object of the attack is to occupy defended waters, it is obviously necessary that the guns bearing on those waters should first be silenced; and, if the occupation is intended to be permanent, the forts must be rendered untenable by the defenders; this may be accomplished either by bombardment from the ships alone, or, more usually, by a combined attack from land and sea.

Where the defended water is an open roadstead, whatever the object with which it is attacked, that attack must take the form of a bombardment; since the object will have to be accomplished in water covered by the fire of the forts.

In the case of a channel leading into a harbour, or the mouth of a river, if the object is to seize or destroy material or shipping beyond the forts, it would not always be necessary to bombard these forts. Armoured vessels, if able to pass the forts at speed, might well afford to neglect their fire; and it is to prevent this action on their part that channels are protected by submarine mines, booms, and other obstructions; so that ships may be delayed under the close fire of the shore guns. These obstructions would therefore have to be first dealt with by the enemy; and, when a channel through them was cleared, the ships would probably attempt to run past without returning the fire of the forts more than would be necessary to render that fire less accurate; and when conditions were favourable, to cover themselves with their own smoke.

It seems probable, however, that these tactics would only be attempted when, having passed the forts, ships could reach safe positions out of the fire of the guns on shore; for should a ship run past forts at the entrance of a harbour, only to find herself engaged by inner defences; she would run the risk, should that engagement go against her, of having to repass the entrance forts with her fighting efficiency seriously impaired, and so perhaps be hopelessly crippled in getting out. But if she is able to get to safe waters beyond the forts, she could probably rely on getting out again with as little damage as she sustained in getting in.

There are thus two forms of attack by ships to be guarded against, "bombardment" and "running past," and these might be used in combination.

Some authorities hold that no bombardment of forts by ships is ever likely to be again attempted. This opinion seems to be arrived at from a consideration of the difficulty of the task of silencing shore

guns, in well-constructed batteries; and also from the fact that, with modern range and position-finding instruments, the accuracy of the fire of those guns has been enormously increased. This latter advantage has not been counterbalanced by any corresponding advance for guns afloat; the difficulties of finding the range, and of obtaining accurate fire from an unsteady gun-platform, having still to be overcome.

However, even in the days before rifled ordnance, the superiority of shore guns was recognised, and it used to be laid down that a battery of four guns well mounted, should be able to give a good account of a 120-gun ship; bombardments were attempted and successfully carried out in those days and so may possibly be again. At any rate as gunners we are more concerned with the methods by which we may hope to successfully resist such an attack, should it occur, than with the question of its likelihood; and by being well prepared to meet it we shall render its attempt less probable.

Should then an enemy decide to seriously engage the forts, it is probable that he will bring his ships to as close a range as possible, for it is only by coming to close range that he can hope to make good practice; and since the fact of bombardment being resorted to presupposes a great superiority in guns, and consequently a large number of ships, it will be necessary for them to anchor, as at close range they would not have room to manœuvre.

At Alexandria the fleet commenced the action at very long ranges and in motion, but finding that their fire was not very effective under those conditions they anchored, still at considerable ranges; but as a matter of fact the damage done to the armament was not heavy, and it has been stated that of the guns which were silenced only three could not have been remounted in time to renew the action the following day; so that, had the defence been determined, it would probably have been found necessary to renew the bombardment at a closer range.

In the American Civil War at the Federal attack of Fort Fisher the first bombardment, lasting two days, was a failure in spite of the fact that the fleet consisted of some sixty vessels carrying 619 guns, while Fort Fisher only mounted 44 guns in all, of which 24 were on the sea front. In the second bombardment which lasted four days, the fleet came in much nearer, and each vessel was told off to attack a certain gun, the range to which from its station was previously ascertained: the guns on the land front were completely silenced, 16 being rendered *hors-de-combat*, and the place, after resisting one assault, fell to a second assault by an overwhelming force from the land side. Confederate accounts state that 50,000 projectiles were thrown into the fort by the fleet.

Every effort should be made to open an effective fire on the fleet whilst advancing to take up its positions, as it is during this period that the forts will have the advantage over the ships; and, by a well-directed fire, the plans of the enemy may be so deranged as to prevent some of the ships reaching their assigned stations; besides which it is of importance to draw the fire of ships as early as possible so as to exhaust their ammunition, their supply of which must necessarily be limited.

A question to be considered is whether the fire of the shore guns should be concentrated on a few ships or distributed over the whole fleet; generally speaking the best method would appear to be, to concentrate on a few ships, preferably those at shortest range or which had succeeded in causing most annoyance, with the greater number of guns; distributing the fire of the rest sufficiently to cause a feeling of insecurity and consequent loss of accuracy; it would certainly be preferable, whilst the fleet was in motion, to totally disable one ship rather than to inflict slight damage on several.

Whenever two or more forts can bring a cross-fire to bear on a ship, she should be attacked by those forts, as it will prevent her taking her station in such a position as to be secured from dangerous hits.

A large part of the secondary and movable armaments should be used to keep down the fire of the auxiliary armament of the ships (quick-firing and machine guns) which would be directed at the embrasures or ports to prevent the guns being worked.

High-angle fire from guns of the primary armament specially mounted, and from howitzers of the movable armament in concealed positions, would be especially dangerous to ships at anchor; and, when a sufficient number of them are available, it would perhaps be advantageous to withdraw the gunners from the direct-fire guns as soon as the fire from the ships began to tell, until the howitzers had succeeded in somewhat reducing that fire.

Ships can make no effective reply to this kind of attack unless they have vessels specially constructed to carry howitzers; and even then, since the vessels must be visible from some point on shore, while the batteries may be so placed as to be invisible from the sea, it is difficult too see how the ships could observe their fire and correct their ranges with anything like the accuracy attainable by the shore batteries.

Should the enemy's fleet only wish to bombard the fortress with a view to producing moral effect, or to divert the attention of the defenders from some other operation which is being simultaneously attempted; such as landing troops, destroying mines or other obstructions, or the attempt by other vessels to force a passage; the ships engaged in the bombardment will not commit themselves to a serious engagement, and, in order to minimise the risk of being crippled, will keep on the move.

In view of the fact that accurate fire can now be directed on objects in motion, we should be able to compel such vessels to keep at so long a range that their fire cannot be very accurate or much to be dreaded.

It should be noted, in considering the kind of attack to which any coast fortress is liable, that the amount of risk to which attacking vessels would be willing to expose themselves, would depend in great measure on the distance from their base, and the possibility or otherwise of their being attacked on their way there to refit, by hostile vessels; the further off the base and the greater the probability of such attack, the less likely are they to run serious risk of being crippled in attacking coast defences.

A bombardment by vessels in motion would, as has been said, be usually resorted to for the purpose of covering some other operation;

while therefore replying to it sufficiently to keep the vessels at a distance, and to prevent such an attack from becoming dangerous in itself, the main power of the defence would be directed to defeating the ulterior object of the enemy. Should this object be the landing of a force, arrangements should be made to keep up as heavy a shell fire as possible on the landing places and their approaches; for this purpose a large part of the secondary armament (and possibly a portion of the primary armament) should be held in reserve, as also batteries of movable armament. These guns should not open fire until the boats carrying the landing parties are within effective shrapnel range, so that they may not prematurely show their position and draw on themselves the fire of the fleet. As the boats near the landing the fire from the ships must necessarily slacken and then the heaviest possible fire should be opened from all available guns on the boats.

Ranges from forts and from the positions of the movable armament to landing places would be ascertained beforehand, and Group officers would be provided with charts showing the fire-area of their guns and these ranges, so that if they have to act independently they may still be able to keep up effective fire. Infantry and machine guns would be used to assist in the defence.

The conditions necessary for a successful attack by landing parties are that the garrison should be taken by surprise, or that the attacking force should be superior in numbers and the defenders shaken by a preliminary fire from the ships (these were the conditions which resulted in the fall of Fort Fisher) ; the best way to obviate this is that the defenders should not unnecessarily show their positions and that the enemy's ships should be kept at such a distance as will ensure their fire being ineffective.

The destruction of mines, or other obstructions in the channel, would usually be attempted by boats under cover of darkness, fog, or the smoke of the ship's guns (as was successfully done at Milford Haven). In the first instance this attack would be resisted by boats of the defence, but if these were unsuccessful they would draw off behind the obstructed channel, leaving the further defence to the Artillery. Quick-firing and machine guns are the best weapons for this purpose, but they would be assisted in most cases by other guns of the secondary or movable armament. If the attack takes place by daylight, or if the electric-light can be used, the enemy's boats would be attacked by the ordinary methods of fire-control; but if, by reason of fogs, &c., the boats cannot be seen, other means have to be adopted. For this purpose the mine-field (or obstructed channel) is divided into portions, and to each portion certain guns are allotted; the range and training to the centre of its portion and length of fuze are ascertained and painted on the range-board or side of the gun-carriage. Elevation is given by index-plate or other means of giving quadrant elevation; or, if the guns are not so fitted, by clinometer, in which case the elevation in degrees and minutes, taking into account the height above the water, must be calculated ; (all converted 64-prs. and 80-prs. now have planes cut on them for using the clinometer). The training must be arranged for when there are no arcs, by marking the racers, or by nailing battens

or painting lines on the platforms against which the trucks, or wheel and trail, can be brought at each round, so that the guns will point in the required direction; or laying-back points may be established. Great accuracy of laying for line is not however necessary. A previously agreed upon signal would show when the defended area was clear of the defending boats, when a rapid fire of shrapnel (and case shot from guns within case shot range) would be opened.

Should an attempt be made by a squadron to force the passage of a channel, whether under cover of bombardment or not, every effort would be made to so disable the leading vessel or vessels as to cause a check in the advance of the squadron, and detain them under fire of the forts. An instance of the effect such a check would have, occurred during the battle of Mobile Bay, 5th August, 1864.

The Federal fleet consisting of 14 wooden vessels and 4 monitors under Admiral Farragut succeeded on that day in passing Fort Morgan which defended the entrance to the bay. The deep water channel was partially blocked by torpedoes so that vessels would have to pass close under the guns of the fort. The fleet advanced in two lines, the wooden vessels, lashed together in pairs, forming one line, and the monitors the other; these being on the right of the wooden vessels and between them and Fort Morgan. When opposite the fort the leading monitor the "Tecumseh," bearing too much to the left was sunk by a torpedo, and the alteration in her course also caused the leading wooden vessel to come on to the line of torpedoes, on perceiving which she stopped, thus throwing the whole line into confusion and checking their advance under the guns of the fort; the check lasted about ten minutes, till the flag-ship taking the lead passed in safety over the torpedoes, and the whole line straightening out again, passed beyond the fire of the fort.

Reports by Federal officers show that the damage and loss of men caused by the fire of the fort, and of the Confederate gunboats, during the check was very heavy, and they state that had it lasted a few minutes longer the attempt would probably have ended in disaster.

In resisting such an attack, then, it seems that the best policy would be to attack the leading ship, or ships, with every gun that can bear on them; and that the object shonld be to attack the "vitals" of the ship rather than to inflict losses on the crew or damage the armament.

In a lecture[1] Captain May, R.N. states "that probably the oldest ironclads as being the least valuable, would be employed to lead the line;" this should make the task of stopping them easier for us, as such ships are not usually provided with such heavy armour as more modern vessels.

High-angle fire, on account of its comparative inaccuracy, is not of much account against vessels in rapid motion; but where a channel has a narrow part, such that a vessel passing through must keep approximately to the centre of it, and therefore at a known range, salvos might be fired at her as she passed that point with good effect.

While the main effort should be directed to stopping the leading

[1] Published in R.A.I. "Proceedings."

vessels, it would not be well to entirely neglect the others, since it is always advisable to draw the fire of ships, and cause them to exhaust their limited supply of ammunition.

Should the forts be successful in checking the advance, the fire should then be distributed on the fleet, with a view to doing as much damage to the armament and inflicting as heavy losses as possible on the crews during the time that they remain under the fire of the forts; any vessel absolutely stopped, might safely be left to be dealt with by the high-angle guns, if there are any.

The choice of the objective on which fire is to be opened by forts, rests with the Section (or Sub-section) Commander, who will indicate to each Fire Commander the vessel he wishes him to attack, and in some cases will also give orders as to the effect which he wishes the Fire Commanders to produce viz.: whether the ship is to be stopped or the armament to be attacked, &c. Fire Commanders should however be prepared to act independently should circumstances require it; such as for instance, a break-down in the means of communication with the Section Commander. Therefore Fire Commanders must have a thorough knowledge of the general scheme of defence as far as the action of their own fort is concerned.

As an action progresses, if the enemy's fleet is partially successful, and the attack pushed home, the tactical control will tend more and more to fall into the hands of subordinate commanders, and eventually into the hands of Group officers; these officers must therefore be prepared to undertake the responsibility. At this stage of an action there would not be much opportunity of choosing the objective, and they would have to fight their guns at any object they could see; a thorough knowledge of the water area covered by their group and of the proper projectiles to use against various objectives is therefore essential.

The control must never be allowed to pass out of the hands of Group officers into those of the Gun Captains. Good effect can only be produced by concentration of effort, and the longer the control can be kept in the hands of the commanders of the larger units the better the effect will be; if allowed to fall into the hands of Gun Captains all power of concentration is lost and it is only by chance that any good effect can be produced.

The question, "at what ship shall we fire?" having been decided, the next consideration is what damage shall we attempt to inflict on her? in other words, what part of the ship shall we try to hit and what projectile shall we use? In order to decide the answer to these questions some knowledge of the construction of warships is necessary.

In the first place we may note that it is of no use studying the vessels of our own navy, since we shall not have to engage them; nor is it necessary to consider the navies of the lesser naval powers, since they are unlikely to be brought against our fortresses, nor do they present any great peculiarities; the only navies which it is necessary to consider as affording distinct types are the French, Italian, and Russian; and this much reduces the difficulty of the task.

It is as well clearly to understand that as a general rule ships are built, not to attack coast defences, but to fight other ships. Their

weapons are guns, torpedoes and the ram, of which the two latter are useless against coast defences. The armament is divided, much as coast armament is, into primary armament, consisting of a few heavy armour-piercing guns, the secondary battery, serving the same purpose as our secondary armament, and the auxiliary armament of light quick-firing and machine guns, roughly corresponding to our movable armament.

It is, of course, essential that a ship should be able to float, steer and steam throughout an engagement, therefore her "vitals," that is her engines and boilers and her power of flotation are protected by side (vertical) armour or by a protective deck at or near the water-line (horizontal armour) or by a combination of the two. It is also desirable that her armament and crew should be protected, but this is not so essential as the protection of her "vitals," since even if her guns are silenced, provided she can steam at speed, and her stability and steering gear are intact, she can hope to defeat her enemy with the ram or torpedo.

In the earliest ironclads we find that complete protection was afforded to the "vitals" and the armament by casing the whole hull in armour, but as the power of guns increased, it was no longer possible for ships to carry the enormous weight of armour necessary to thoroughly protect the whole hull; we therefore find that certain parts of the ship are left unprotected, the armour being concentrated on the water-line and on a central citadel containing the most important part of the armament.

Further increase in the power of guns, and consequently of the weight of armour to be carried, rendered the abandonment of the citadel necessary; so that in general, we may say that, in modern foreign ships, the vitals are always protected; the primary armament is either completely protected, by being mounted in turrets, or partially so in barbettes; while most usually the secondary armament is completely unprotected. The auxiliary armament has only the protection of bullet-proof shields, and is generally mounted on the upper deck and in military tops. Breech-hoods are sometimes added as a protection to the crews of B.L. guns, mounted *en barbette*, and in some few cases guns have been mounted on disappearing carriages.

There are several points which it is desirable to know as regards ships, such as their speed, draught (which limits the positions on the water area in which they can place themselves), length and breadth (which define the size of the target offered), appearance, and the nature and disposition of the armament; but the all-important considerations with regard to the question we are now considering are: what is the *nature* of the target offered? how far is it vulnerable to our fire? and what is the most advantageous portion to attack? and these questions can be answered when we know the thickness and disposition of the armour.

From this point of view the battleships, coast defence vessels and gunboats of the French navy can be grouped into three main divisions depending on the disposition of the armour; all of them have complete water-line protection by side armour, and some have in addition armoured decks.

These three main divisions are 1st, Central Citadel Ships, 2nd, Turret Ships, and 3rd, Barbette Ships. The 1st division, which includes most of the older efficient vessels, provide more or less complete protection for the principal part of the armament; we will take as an example of this division the "Courbet;" this vessel has a water-line belt, five feet above the water and five below, fifteen inches thick amidships tapering to ten inches fore and aft, there is an octagonal citadel in the centre, having 9·5 inches of armour, in which are mounted four 34 cm. 48-ton guns so arranged that two can fire ahead, astern, or on each broadside, there are four 27 cm. 23-ton guns, two in barbettes unarmoured on the top of the citadel and one each at bow and stern unprotected; also six 3-ton guns unprotected. There is a steel deck about the water level of 3·25 inches. The whole of the unprotected armament (10 guns) can be put out of action by any guns able to reach them, whilst the primary armament is vulnerable to 10-inch R.M.L. guns, either broadside, or end-on at ranges under 2000 yards or to 6-inch B.L. guns at 1500 yards; while the water-line armour at its thickest part would be penetrated by the 12·5-inch R.M.L. or 9·2-inch B.L. at 3500 yards; also the hull above the water-line could be seriously damaged by common shell from medium guns over two-thirds of the length of the ship.

As an example of the second division, turret ships, we will take the "Bouvines," this vessel is not yet completed, she will have a belt of a maximum thickness of 18 inches, a steel deck probably 4 inches. The primary armament of two 34 cm. guns is disposed in two turrets, fore and aft, armoured with 17·75 inches. The secondary armament of four 10 cm. quick-firing guns is unprotected; there are strongly armoured ammunition hoists to the turrets; she is classed as a "Coast defender." Her armour is beyond the power at 2000 yards of any guns below the 16-inch R.M.L. or the 10-inch B.L., but common shell entering below the turret and above the belt would possibly render the turret guns useless; the whole of the hull above the belt, including the secondary armament, is vulnerable to shell fire of light guns.

For an example of the third division, barbette ships, we will take the "Marceau," this vessel has a water-line belt varying from 18 inches amidships to 12 inches aft, her primary armament of four 34 cm. 52-ton guns is carried in four barbettes armoured with 16-inch armour and provided with hoists having 9-inch armour; they are placed one forward and one aft and two on sponsons amidships; her secondary battery consists of eight 14 cm. 2½-ton guns on each broadside and one at the bow all unprotected; she has a 3·7-inch steel deck. Her water-line armour is penetrable by the 10-inch B.L. gun at 2500 yards; her primary armament could be disabled by direct hits on the guns themselves or by shells entering beneath the barbettes and above the belt, or by high-angle or plunging fire of any guns, while her secondary battery is vulnerable to any guns. The greater part of the French battleships and gunboats consist of vessels which may be placed in this division.

Each of these main divisions includes several sub-divisions, the ships in which differ in the thickness of armour carried and in size; but the disposition of the armour and armament is approximately the same throughout the division.

Of Russian ships there is one small class consisting of three vessels the "Catherine II.," "Tchesmé," and "Sinopé," which are built on a design peculiar to that navy. They have a belt varying from 16 inches to 8 inches; above the belt is a citadel with 12-inch armour on the sides, 9-inch and 10-inch on the bulkheads; on this again is a pear-shaped redoubt, 12-inch armour, and on this are three barbettes, 14-inch armour, two abreast forward and one aft; in each barbette are two 50-ton guns, in the first two the guns are on disappearing carriages, in the last the guns are on ordinary carriages; there is a 3-inch steel deck; the secondary armament of seven 6-inch guns is outside the citadel, four in front of it and three astern. The primary armament can only be attacked by high-angle or plunging fire or by guns capable of piercing 14 inches of armour; the secondary armament is partly protected from end-on fire by the citadel, but is wholly vulnerable to broadside fire. On the whole these vessels would probably sustain less damage to their armament in an action with coast defences than any yet described; but, as they are stationed in the Black Sea, would probably not be employed against any of our home fortresses. The two circular ironclads "Novgorod" and "Admiral Popoff" constitute a type peculiar to Russia but stand the sea so badly that they could not leave the Black Sea and need not be described. For the rest the Russian vessels do not differ much from the French, except that in two belted barbette ships the "Nicolai II." and "Alexander II.," the secondary battery is protected against end-on fire by armoured bulkheads and a gun at each end of the broadside battery is protected by thin side armour.

The peculiarity of the Italian ships is that they do not have complete water-line belts but rely for protection of the vitals on armoured decks. There are roughly two divisions viz,: central citadel ships and barbette ships. Of the central citadel division some carry their principal armament in turrets some in barbettes.

The "Dandolo" and "Duilio" are of the former class, they have a water-line belt of wrought-iron 21½ inches thick for about one-half of their length, on this a citadel and over that two turrets, 18-inch armour, placed diagonally, the principal armament being four 100-ton R.M.L.; the small secondary battery of three 12 cm. B.L. is outside the citadel.

With these ships the thickness of the armour would render its attack by the guns usually mounted on shore hopeless, but the very large unarmoured target could be completely destroyed and the ship probably fatally crippled. The "Sardegna" is an example of the barbette type, she has no side armour; her primary armament of four 67-ton B.L. guns is carried in two barbettes, 18-inch compound armour, to which there are armoured hoists; there is an armoured deck; the secondary battery, unprotected in any way, consists of eight 15 cm. and six 12 cm. guns. This ship seems very unfitted to engage coast guns; the small armoured target would not be worth firing at, as the ship could probably be placed *hors-de-combat* by common shell.

It is impossible in the limits of a lecture to give even the shortest account of all the various types to be found in foreign navies; those described have been selected as being fairly representative of their class.

Besides battleships and gunboats there are in all navies armoured and protected cruisers; the former having vertical, the latter only horizontal armour. None of them are likely to engage coast defences; in the armoured class the armour is too light to ensure protection against the lightest armour-piercing guns, and with very few exceptions the armament is entirely unprotected.

Before we can determine on the rules which should guide us in the choice of a method of attacking a ship of given type, we have to consider the powers and uses of our projectiles.

First, as regards the attack of armour. Armour, as applied to ships, is of three kinds, viz., wrought-iron, steel, and steel-faced iron, usually called compound; these three varieties behave differently under attack.

Wrought-iron yields locally; it is punched or perforated, a clean hole being made in it. The entire shield is generally capable of resisting a subsequent blow as stoutly as it resisted the first. Partial penetration is practically useless, however often it may be repeated.[1] It is obviously therefore useless to attack this species of armour unless the power of the gun is equal to driving its projectile through the armour.

A measure of the power to penetrate is given by the rough rule that, in order to penetrate its own diameter into wrought-iron, a shot must strike with a velocity of 1000 f.s., and its penetration with greater or less striking velocity will be in proportion; thus, a 10-inch shot striking with 1000 f.s. will penetrate ten inches of wrought-iron armour, with 500 f.s. it will penetrate five inches, and so on.

This rule gives the penetration which may be expected when the shot strikes the plate in a line normal to its surface; when it strikes at an angle, the thickness of plate that can be perforated is in proportion to the sine of the angle at which it strikes; thus, it may be useful to remember that striking at 60 degrees to the surface a shot will penetrate roughly six-sevenths of the thickness it would penetrate at the normal. Below 50 degrees the shot will glance from wrought-iron; from hard armour the shot will glance below 65 degrees.

Steel-faced and steel, called "hard" armour, yields by fracture, the plate cracking radially from the point of impact, these cracks extending through the thickness of the metal in the case of steel (soft steel, however, occasionally has been perforated, behaving more like wrought-iron). These armours not admitting of perforation, as a rule,[2] can only be destroyed by repeated blows, cracking, and stripping off the plate. Though a heavy gun with a single shot may not effect much against them, repeated blows from lighter guns may succeed in destroying the armour and eventually penetrating the ship's side. This, at considerable range, or against a ship in motion, would obviously be a difficult task to accomplish. In the table of penetrations given in the Tactical Manual, a note states that damage equivalent to penetration would be effected against hard armour of the same thickness as wrought-iron, which would be just penetrated by the gun; it is important to under-

[1] Attack of Armour. Captain Orde Browne. Vol. XV., p. 308.

[2] Major MacMahon, R.A., gives the following rule for ascertaining the penetration of compound armour by *steel* shot. The penetration is equal to four-fifths of the calibre of the shot for every 1000 f.s. striking velocity. Thus, the steel shot of the 10-inch B.L. gun will penetrate 8-inch compound armour with 1000 f.s. striking velocity.

stand the bearing of this. In the case of iron armour, the shot penetrating, though it only damages the plate at the point of impact, will probably do serious damage to whatever is behind the plate; whilst with hard armour no such damage will be done, but the plate will be less able to resist a subsequent blow.

It should be remarked that a shot which only just gets through the armour may not affect much damage, since its energy will have been almost entirely destroyed, and it may still have to pass (probably if a Palliser shot in a broken condition) through obstructions, such as coal-bunkers, bulkheads, &c., before reaching a vital part of the ship.

Horizontal armour may be attacked by direct fire provided the angle of descent is over 10 degrees and the striking velocity sufficient; the penetration at this angle being about one-fourth of that obtainable with an equal velocity by a direct hit on vertical armour. The angle of descent depends on the range and on the height of the gun above the object; tables, an example of which is given in the Tactical Manual, must be worked out in each fort, according to its height above the water. It must be remembered that the armoured deck is usually about at the level of the water, and that there are generally one or more decks above this, so that the shot will have to pass through obstructions, losing some of its force before it reaches the armoured deck.

Common shell can be used against thin wrought-iron armour the perforation being equal to half the diameter for each 1000 f.s. velocity;[1] but the backing would greatly impede the further course of the fragments: in this case the shell should be plugged.[2]

As regards the attack of armoured decks by high-angle fire, the same rules for finding the penetration apply as in other cases. Steel shot are the best projectiles for this purpose, as they are less liable to break up when striking an object not truly point first, than are Palliser shot. Shot would, of course, be very liable to be deflected by upper works of the vessel before reaching the armoured deck, and so may strike in any position.

The attack of unarmoured ships, or unarmoured portions of armoured vessels, would be carried out with common shell when it is desired principally to inflict damage on the vessel and its armament; and by shrapnel when it is desired to cause losses among the crew. Common shell plugged have been found to explode when passing through thin armour or the sides of unarmoured iron ships, and Capt. Nash, R.A., has therefore proposed to use them with plugs in preference to fuzes, but, as has been pointed out by Capt. May, R.N., the time taken for a fuze to act and for the shell to burst will be long enough to allow it to penetrate unarmoured sides, while there are many objects on deck—funnels, spars, &c.—which, while offering sufficient resistance to set in action the fuze, would probably not explode a plugged shell. It would

[1] Captain Orde Browne. Vol. XIV., p. 131. It is not quite clear whether this measure of the power to penetrate is intended or not; Text-Book of Gunnery gives "half the diameter at short ranges."

[2] The resistance offered by armour, approaching the thickness which the shell can penetrate, would check its velocity so much that a fuze would act before penetration was complete; in the case of unarmoured sides, the resistance would not be sufficient to cause this check.

be best then to lay it down as a rule that common shell be fired with percussion fuzes, but as an exception at short ranges, when we can make sure of hitting the side, they *may* be fired plugged.

Shrapnel is used as a man-killing projectile, and has been found to break up well, in passing through a target of one-inch iron representing the unarmoured portion of H.M.S. "Shannon," when fired plugged. The same remark as in the case of common applies here also, so unless we can make sure of hitting the side, it would be safer to use percussion fuzes. Time shrapnel could never be used with good effect against vessels in motion from heavy guns; the range prediction has to be made before the fuze is bored or set, and consequently the time that would elapse during the boring of the fuze and loading, etc., the gun, would make the chances of the shot being successful very small. Time fuzes could be used, however, advantageously against ships at close ranges at anchor, when it is desired to clear the upper decks and tops of small-arm men, and crews of machine guns.

The auxiliary armament of quick-firing guns being behind bullet-broof shields, must be attacked by common or percussion shrapnel.

Open boats would be attacked by time shrapnel or by case shot when within effective range of that projectile. Torpedo boats would probably have to be dealt with by quick-firing guns of the lighter natures; common or percussion shrapnel may be employed against them, or heavy time shrapnel at close ranges, and even case shot.

The proportions of the various projectiles supplied are for R.M.L. guns unsupported by secondary armament, 15 shrapnel, 10 case, and 40 each common and Palliser, while, if so supported, they have no shrapnel or case, and 50 each common and Palliser. For B.L. guns a larger proportion of common to Palliser is supplied:[1] they have no case.

We can now sum up these various considerations, and arrive at rough rules for our guidance in the choice of the portion of a vessel to be attacked, and the best projectile to attack it with.

Speaking generally, the choice as regards the portion of ship lies between the armoured and unarmoured part, and as regards the projectile between armour-piercing shot and common shell. Now, from a consideration of the distribution of armour in foreign ships, it is evident that most of them can be very heavily damaged by attacking the unarmoured portion. Besides the armament and crew, there is a great deal of subsidiary machinery, communications, etc., which is unprotected in all ships, so that every shell bursting between decks is sure to more or less cripple the fighting efficiency of the ship; and in proportion to her distance from her base, so would any ship be unable to endure more than a certain loss in guns, men and material. From a consideration of the nature of armour, we see that unless the shot can do more that merely penetrate it, or unless we can get several successive or simultaneous hits on hard armour, we cannot expect much damage to result to the "vitals" of the ship. Again, the target offered by the armour is a difficult one, consisting as it usually does of a narrow belt, never more than five feet, and in some cases only one foot nine inches above the water; and of one or more patches at different

[1] Except with 9·2 inch, which has an equal proportion of the two.

parts of the ship; whilst the unarmoured portion offers a large target, bearing a proportion of from 3 to 2 to 4 to 1 of the armoured target in most vessels. On the other hand, a shot passing through the armour belt and reaching the engine-room or boilers *may* stop the vessel (the "Huascar" was *not* stopped by a shell which reached the engine-room, killing and wounding four of the staff employed there) or *may* blow up the magazine. On the whole, therefore, it seems decidedly preferable to attack the unarmoured portion; at any rate, with the greater part of the armament; while a few heavy guns may attack the armour when *well* within their power, and at a range where close shooting may be relied on—say 1000 yards with M.L. guns.

One case was pointed out where it would be preferable to attack the vitals of a ship, viz., in attacking the leading ship of a squadron attempting to force a passage; and then for the reason that the fire of the forts having to be distributed over a number of ships, unless by stopping or checking their progress we can gain a little time in which to fire at them, we shall not be able to inflict damage, on the greater number, sufficient to cripple them. This reasoning would not apply to one or two vessels attempting to slip past; the fire of a large number of guns can be concentrated on them, and even in a very short time they should suffer so much in crews and armament that they would become easy prey to any small gun-boats or torpedo boats which could follow them up.

As to the armament of a ship, her secondary battery and auxiliary armament would probably cause us most trouble, and therefore should be first attacked; primary guns in barbettes can be usually rendered useless by the explosion of heavy common shells beneath the barbette. If there is a weak point in the ship, as for instance the absence of armour on the hoists in a barbette ship, that weak point should be attacked.

We can now give rough rules as a guide for Fire Commanders in the attack of ships.

1. Fire should be opened at as long a range as possible with common shell and percussion fuze, unless the armoured deck is *well* within the power of the gun at that range.
2. When the range has decreased to the point at which penetration of the armoured deck may be reasonably expected, use armour-piercing projectiles until further decrease of the range causes the angle of descent to fall below ten degrees. If no penetration can be attempted, use percussion common at the deck till this angle of descent is reached.
3. When the armoured deck can no longer be attacked (by direct fire), use percussion common at the unarmoured portions of the vessel. A part of the secondary armament, or one or two groups of heavy guns where there is no secondary armament, should employ percussion shrapnel at the upper deck and at the secondary battery (percussion or plugged).
4. When the range is further decreased to the point at which the guns are *certainly* more than a match for the vertical armour

of the ship (taking into account the inclination of her course to the line of fire); and at which (taking into account the size of the armoured target) there is reasonable hope of hitting it, use armour-piercing projectiles at that armour, for preference choosing the belt to fire at.

5. The attack of the unarmoured parts of the vessel by percussion common and plugged shrapnel should be continued simultaneously with the attack of the armour, the latter task being allotted to a portion only of the heavy armament. (Common may be used plugged when the range is such that there is little likelihood of missing the side of a ship).

6. Quick-firing and machine and field guns should be employed to keep down the fire of the auxiliary armament in the tops and on the upper deck; and at close ranges to fire at the ports, and where the height of site admits, into the barbettes.

7. At close ranges time shrapnel should be used to clear the decks and prevent the working of guns in barbettes of stationary vessels.

8. Against armoured cruisers of the type of the "Dupuy-de-Lôme," (viz., having completely armoured hulls or other lightly armoured vessels), attack as above, except that, when the range is such that penetration of the armour by common shell may be expected, use that projectile, plugged, against the armour.

The same general rules govern the choice of projectiles for high-angle-fire guns as for direct-fire guns.

Howitzers of the movable armament would occasion much damage, especially to barbette ships, by a fire of percussion common, but could only, as a rule, be employed against stationary vessels; or by laying on a spot at a narrow part of the channel over which the vessel must approximately pass.

It is not expected that Fire Commanders will be able to employ formulæ and remember rules to any great extent during action; to aid them, therefore, tables will be supplied containing the names of all vessels likely to be engaged (a separate table for each nation), divided into types. These tables will give a general description by which the type may be recognised, information as to dimensions; nature, thickness and distribution of the armour; nature and distribution of the armament; and any special points, such as parts of the vessel particularly open to damage; thus far the tables would be of general use, for each fort must be added the ranges at which the armour becomes penetrable by the guns of the fort, and the general lines on which the Fort Commander should conduct the action, having regard to the power of his guns and the conditions imposed on the vessel by the particular circumstances of the water area.

The Section Commander, when pointing out to a Fire Commander the particular vessel which he is to attack, will also, as a general rule, inform him of the type to which that vessel belongs, and, if possible,

the name (or number on the list) of that vessel; so that the Fire Commander, referring to his list, will be able to see at a glance the general idea of the form which his attack should take. To enable the Section Commander to do this, an officer of the Navy, or other person competent to recognise foreign vessels by their appearance, will probably be attached to his staff; this does not, however, relieve officers from the necessity of studying the appearance and characteristics of such vessels; in fact, such study should be looked upon as an important part of their duty by all officers who may have to take part in the defence of a coast fortress.

The question of the rate and order of fire to be adopted is decided more by considerations that come under the head of Fire Control than by those coming under our present heading. The following points should, however, here be noted :—

A given number of shots penetrating soft armour will probably do an equal amount of damage whether they strike successively or simultaneously. The damage done to a ship protected by hard armour by a given number of shots will probably be much greater if they strike the armour simultaneously than if they strike in succession. The simultaneous explosion of several heavy shell between decks may be expected to produce much more disastrous effects than would be caused by the same number exploding singly. The "racking" effect on the ship generally will certainly be greater if the projectiles strike at the same instant.

For these reasons guns are in almost all cases fired in salvos by groups, the only exceptions being when ships are lying off at long range and the action is likely to last a long time, and when at the commencement of an action a few trial shots are fired to obtain the necessary corrections. The groups may either fire independently, "Independent Group Fire;" or in succession, "Succession Group Fire." The former gives the greatest volume of fire in a given time, and slowness of loading by one group will not delay the others; as a general rule it would be used when laying by quadrant elevation and training arc, while Battery group fire, commencing with the leeward group, would be resorted to when using sights to avoid interruption of the laying of one group by the smoke of another. As regards the rate of fire, this would naturally be slow and deliberate at the longest ranges, increasing in rapidity as the range decreases, and the projectiles have more effect; while against ships forcing a passage past forts, the fire, as they approach the part of the channel where they will be at shortest range, should be as rapid as possible consistent with accuracy.

(*To be Continued.*)

ARTILLERY.

	Horse Artillery (1 Battery).	Field Artillery (2 Batteries).	Garrison Artillery (1 Battalion of 3 Companies). [a].
Designation	No. 1	No. 2 and No. 3	No. 1 Coy. No. 2 Coy. No. 3 Coy.
Where quartered	Cairo	Cairo Frontier	Cairo. Frontier. Suakin.
Description of gun	7½ cent. Krupp	6 cent. Krupp	9 cent. Krupp.
No. of guns per battery	6	6	
Weight of gun	4 cwt. 64 lbs.	2 cwt. 12 lbs.	9½ cwt.
Draught	Pole with Syrian horses [b]	5 mules and 3 camels per gun [c]	
No. of rounds per gun, 1st line	27 in limber	24 on mules	
do. do. 2nd line	39 in limber	48 on camels	
Weight of shell	Ringed 9·46 lbs.	Ringed 7·48 lbs. [d]	Common 13·7 lbs.
Weight of shrapnel	9·46 lbs.	7·48 lbs.	
Bursting charge of shell	Shrapnel 1·42 oz.	Shrapnel 1·05 oz.	Common 8·45 lbs.
Service charge of cartridge	28·24 oz. [Eg. F.G.]	11·20 ozs.	3·08 lbs.
Range of gun	6017 yards	4370 yards	5905 yards.
Effective range of shrapnel	2627 yards	2409 yards	
Establishment [e] Officers	6	6 (Each Battery)	14 [f] (Garrison Battalion.)
,, W.O.'s, N.C.O.'s and men	153	133 (Each Battery)	450 (Garrison Battalion.)
,, Civilians	6	6 (Each Battery)	11 (Garrison Battalion.)
,, Horses	166	11 (Each Battery)	2 (Garrison Battalion.)
,, Mules		30 (Each Battery)	12 (Garrison Battalion.)
,, Camels		21 (Each Battery)	

[a]. Each Company is divided into three sections, each section under a subaltern officer.

[b]. Weight behind teams—22 cwt. No gunners carried on limbers.

[c]. Distribution :—One mule for gun (weight carried 260 lbs.); one for carriage (250 lbs.); one for wheels and shaft (200 lbs.); one spare. Three camels as relief on the line of march; these camels carry ammunition where not used for the gun and carriage. Weight of ammunition load for one mule = 200 lbs. In addition to the above there are also nine camels per batttery—viz., three for each section as transport.

[d]. The proportion per cent. of ammunition is as follows :—50 shrapnel, 40 ringed, 10 case. The reason of larger proportion of ringed shell to European armies is the small range of effective shrapnel. Common shell is not carried.

[e]. In addition to this, there is also an Artillery Staff; establishment, 3 officers, 16 W.O.'s, N.C.O.'s and men, 4 civilians and 7 horses.

[f]. Including a Garrison Staff; establishment, 2 officers, 3 W.O.'s, N.C.O.'s and men, and two horses.

Designation	N
Where quartered	Ca
Description of gun	7½
No. of guns per battery	6
Weight of gun	4
Draught	Po
No. of rounds per gun, 1st line	27
do. do. 2nd line	39
Weight of shell	Ri
Weight of shrapnel	9·
Bursting charge of shell	Sh
Service charge of cartridge	28
Range of gun	6(
Effective range of shrapnel	2(
Establishment [*e*] Officers	6
,, W.O.'s, N.C.O.'s and men ...	1
,, Civilians	6
,, Horses	1(
,, Mules	.
,, Camels	.

[*a*]. Each Company is divided into three sections, eac

[*b*]. Weight behind teams—22 cwt. No gunners car

[*c*]. Distribution:—One mule for gun (weight carried
of march; these camels carry
the above there are also nine c

[*d*]. The proportion per cent. of ammunition is as fol
range of effective shrapnel. C

[*e*]. In addition to this, there is also an Artillery Staf

[*f*]. Including a Garrison Staff; establishment, 2 offi

NOTES ON EGYPTIAN ARTILLERY.

CONTRIBUTED BY

THE SECRETARY.

THE following brief Notes on the Egyptian Artillery have been kindly forwarded me by an officer of the Regiment who has recently been on leave in Egypt, and may be interesting to Members :—

The tabulated form opposite, as issued from the Head-Quarter Office of the Egyptian Artillery, Cairo, conveys useful information on the armament, *personnel* and general constitution of the batteries.

Command.

The command is vested in an English officer, under whom three English and three Egyptian officers act as Battery Commanders.

The Horse and the two Field Artillery Batteries are commanded by the English officers. The Brigade-Major is an Egyptian officer.

Reliefs.

The Horse Battery remains at Cairo. The two Field Batteries alternate between Cairo and the frontier, relieving each other every two years. The three Garrison Batteries are stationed—one at Cairo, one at Suakin, and one at the frontier. Service at Suakin and on the frontier reckoned at two years.

The R.A. drill-books are the text-books.

Duties.

All duties, drills and exercises, are carried out strictly on the lines laid down in our own orders.

The duties of the 6th officer on the strength of each battery are those of a Staff Officer and Quarter-Master. He is responsible for the correct management of office returns, rations and forage, pay and clothing, thus enabling the C.O. of the battery to devote his time more to the supervision of drills and exercises than to the office returns. When the C.O. is absent, this officer commands.

Rates of pay are as follows :—

Pay of rank and file.

Warrant Officer	150	piastres	a month.
Sergeant-Major	70	,,	,,
Sergeant	50	,,	,,
Corporal	40	,,	,,
Gunner	30	,,	,,

Piastre = $2\frac{1}{2}$d.

Service. Enlistment is by conscription. Length of service with the colours, 6 years. No specially enlisted drivers. Height of gunners 1·73 metres = 5 ft. 8 ins. Chest measurement, 94 centimetres = 37 inches.

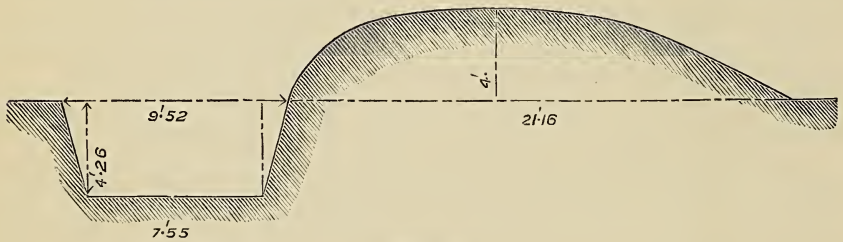
Battery practice. The facilities for battery practice are very great. At any time, with comparatively little trouble and precaution, batteries can go out into the desert and fire live shell. The result is that officers and men become experts at judging distances, and range-finding is found to be of little use. The officers—English and Egyptian—are unanimous in their preference for their gun as a range-finder in the place of the orthodox range-finding instruments.

"Observation of fire," owing to the nature of the country, the mirage, and the absence of prominent landmarks, is difficult to carry out. This applies equally to range-finding. Signalling is little used.

General observations. The marching order parade of the Horse and Field Battery and the Garrison Battery now stationed at Cairo was in January last, from every point of view, as excellent as any parade show of British Artillery.

The physique of the men was as good as that of the gunners of our Horse batteries, the Arab horses appeared in hard condition, the mules and camels fit to go at any moment, and all the officers keen, zealous and eager for further active service.

The horsemanship of the N.C.O. and men of the mounted batteries, and the marching power of the foot gunners were specially noticeable.



Scale $\frac{1}{100}$

The section here shewn is that of a bank and ditch crossed by the Horse battery in line when moving to a flank to come into action in a new position—two pair of wheelers came down, but soon regained their places in line.

The Egyptians make good gunners, judging from their reported conduct at the actions of Hogeen and Toski—800 yards was an ordinary range for the guns in action. Five case were expended in this action of Toski.

Equipment. In the matter of general equipment nothing is noticeable, more than that the kits of the men and camp equipment of the batteries were very much less bulk than in our batteries—accounted for by the smaller wants of the men and the temperate climate of the country.

Pole draught is admirably suited to the country—no complaints of bruised ankles and shin bones from the wheel drivers, such as you hear from the wheel drivers at home. This is due to greater play between the driver's leg and the pole, on account of the smaller type of horses in Egypt.

The pole in use when traces were taut projected about 13 inches in front of the wheel horses.

The following is the man's rations a day:—

6	drahms	of butter.
20	,,	rice.
40	,,	lentil or bean.
5	,,	salt.
5	,,	onion (10 drahms at Suakin).
150	,,	wood (189⅓ drahms at Suakin).
5	,,	soap.
250	,,	bread, or 200 drahms of biscuits.
2½	,,	of petroleum oil, or a candle for every 40 men a night.
35	,,	mutton or beef.
45	,,	vegetables (26 drahms of potatoes at Suakin).
12	,,	lemon juice. } Issued twice a week at Suakin.
6	,,	sugar. }

Drahm = $\frac{1}{146}$ lb. av.

The following are the clothings of the gunner, whether at Cairo or in out-stations:—

	Garrison Arty.	Field Arty.
Greatcoat	1	1
White Tunic	1	1
,, Overalls	1	0
Khakee Tunic	1	1
,, Overalls	1	0
White Trousers	0	1
Khakee ,,	0	1
Pair of Putties	2	2
Tie for ,,	0	2
Cotton Shirts	2	3
,, Drawers	2	2
Tarbooshes, with silk tassel	2	2
Handkerchiefs	2	2
Pair of Stockings	2	2
,, Ankle Boots	2	2
Woollen Drawers	1	1
Jersey	1	1
Cloth Tunic (only at Cairo)	1	1
Cloth Overalls	1	1
Pair of Spurs	0	1
Cloth Pantaloons, at Cairo	0	1

THE BATTLE OF THE VELOCITIES.

BY

CAPTAIN H. A. BETHELL, R.A.

APR 1 1 U.S. PATENT O

During the discussion which followed Captain White's recent Okehampton lecture at the Institution, the question of high velocities in field guns was again brought forward. In view of the opinions then expressed, and of the recent proposal to raise the 12-pr. velocity with cordite charge to 2000 f.s., a detailed examination of the question may be of interest.

The issue may be stated as follows :—

Is the present velocity (1710 f.s.) of the 12-pr. gun excessive ?
Should it be reduced to 1500 f.s. ?
Should it be increased to 2000 f.s. ?

The table on page 424 gives the ballistics for the two latter velocities, for ranges of 1500, 2000, and 2500 yards. I consider these three ranges sufficient for purposes of comparison. By taking longer ranges a better case might be made out for the high velocity gun ; but a good fighting country offers so few such ranges that I think the comparison should be confined to ordinary fighting distances.

In calculating this table I have throughout neglected the check of 133 f.s. given by the head burster of the present shrapnel, which, it is hoped, will soon disappear from our equipment. I have assumed an extra forward impulse of 200 f.s. given by a base burster. This may appear excessive, but is moderate compared with the result attained in the Italian 9 cm shrapnel, in which the 2½ oz. powder charge gives an extra velocity of 150 mètres, or 492 feet per second.

The advantages usually claimed for high velocity are as follows :—

1. Flat trajectory, giving deep dangerous zone.
2. High bullet velocity, giving deep zone of bullet effect and permissible latitude of error in elevation and fuze.
3. Better ricochet effect of bullets.
4. Better effect with case shot.
5. Range and accuracy.
6. Moral effect due to shell outstripping sound.

The objections raised to high velocity are as follows :—

7. Destructive effect upon the carriage, requiring complicated and heavy gear to resist it.
8. Excessive recoil, requiring complicated and unserviceable brakes.
9. Inaccuracy due to excessive jump.
10. Irregularity of burning of fuze.
11. Want of searching power against entrenchments, due to flat trajectory of shrapnel bullets.
12. Necessity for a tough steel shell, useless as a man-killing projectile.
13. Waste of bullets due to wide angle of divergence.

Range.	Angle of departure.	Angle of descent.	Remaining velocity.	Distance from burst at which bullets lose effective velocity.	Angle of opening of shrapnel.	Depth of effective bullet zone, 6 feet high.			Non-effective bullets.			Hits on 6 foot screen. Width unlimited.		
						Burst 100 yards short.	Burst 50 yards short.	Burst 25 yards short.	Burst 100 yards short.	Burst 50 yards short.	Burst 25 yards short.	Burst 100 yards short.	Burst 50 yards short.	Burst 25 yards short.
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.
M.V. 2000 f.s.														
1500 yards	1° 27′	1° 56′	1262 f.s.	432	11° 14′	422	432	432	9	7	6	24	48	96
2000 yards	2° 19′	3° 5′	1099 f.s.	408	12° 2′	385	399	408	5	2	1	22	45	90
2500 yards	3° 25′	4° 33′	977 f.s.	392	12° 40′	363	354	334	—	—	—	21	42	84
M.V. 1500 f.s.														
1500 yards	2° 32′	3° 29′	1006 f.s.	393	10° 40′	360	347	337	—	—	—	25	50	100
2000 yards	3° 48′	5° 4′	930 f.s.	378	11° 3′	290	228	123	—	—	—	24	49	98
2500 yards	5° 16′	7° 2′	865 f.s.	365	11° 26′	223	138	74	—	—	—	23	47	94

Small changes of velocity and inclination due to the distance of burst short of the target have been neglected, as also the extra bullet velocity due to the fall from the height of burst.

The angles of opening have been calculated from Colonel Nicholson's and Mr. Hadcock's formulæ ("Proceedings," April, 1889), 200 f.s. being throughout added to the R.V.

Compare angles of descent for 1500 f.s. with those given by Colonel Nicholson.

Except the last column, which is a rough approximation, I have endeavoured to make this table correct to the nearest foot, yard, minute, and bullet. Any defect in the methods of working is common to both velocities, and does not, I think, affect the comparison.

"Least effective bullet velocity" has been taken at 400 f.s.

Any officer wishing to examine the calculations from which this table was worked out, can obtain them from the Secretary R.A.I.

We will now examine the truth of these assertions.

Taking (1) and (2) together, a reference to Column IV. of the table shows that the supposed disparity in bullet velocity is far less than might be supposed. The high "$\frac{d^2}{w}$" of shrapnel bullets is a great leveller. It is rather a surprise then, on referring to Columns VI.–VIII., to find that the claim of a greatly superior zone of effect is justified by the figures. Selecting a conspicuous case, we see that a shrapnel burst 25 yards short at 2500 yards gives an effective zone of 334 yards for the high velocity against 74 yards for the lower one. This is due to the fact that the sharp angle of descent given by the 1500 f.s. M.V. causes the bullets to bury themselves before reaching the limit of effective velocity.

3. No data as to ricochet being available, I have been unable to work this out. Personally, I do not believe in the effective ricochet of shrapnel bullets at all, except, perhaps, on rock or shingle.

4. Here, again, we find that the supposed disparity is practically non-existent. The effective range of the furthest case-shot bullet is 482 yards for the high velocity, against 436 yards for the lower one. The angles of elevation being nearly the same, there is little difference in ricochet effect.

5. The accuracy given by the 1500 f.s. M.V. is quite good enough for shrapnel fire, and the cases where its range would be insufficient would, on service, be rare indeed.

6. Moral effect. This may at first sight appear trivial, but in these days of civilisation, short service, and short wars, the percentage of nervous men in the ranks will be much higher than heretofore, and considerations of this nature must not be altogether neglected. Colonel Maitland gives an instance of the importance of this point, taken from the Russo-Turkish War, at page 114 of the Text-Book of Gunnery.

7, 8, 9. These points resolve themselves into a question of carriage construction. The new buffer carriage has recently been tried in India on a much larger scale and under conditions more nearly approaching to service than is possible in England. It was found that while several of the fittings of the carriage—the traversing gear, the brake, and especially the long elevating screw—proved unserviceable, yet the main feature of the carriage, the hydraulic buffer, worked well. It is hoped, then, that the new carriage will fully meet the objections as to breaking up and variable jump, and partly that as to excessive recoil. As for the brake, we shall probably come back to the old check-rope in the end. If a spring can be fitted to the trail-eye, so as to combine the functions of an elastic connection between gun and limber and of a point of attachment for the check-ropes, we shall have made a step in advance.

One objection—as to weight of gun and carriage—remains unanswered. We can hardly expect a M.V. of 2000 f.s. from a 5 cwt. gun, and a recoil carriage, however perfect, must be a heavy one. It

is not, I think, unfair to assume a difference of 5 cwt. in favour of the lower velocity.

10. This charge is only too well supported, and so long as we continue to use nose fuzes there seems little chance of improving the performance of the high velocity gun in this respect.

Two remedies have been suggested :—

(*a.*) The base fuze. Assuming the bad performance of the nose fuze to be due to irregular air-pressure, a fuze in the base of the shell, where the air-pressure is almost nil and consequently its variations infinitesimal, may be expected to act well. It has several advantages over the nose fuze, one of which is its convenience for use with a base burster. The principal reason for its non-adoption seems to be a prejudice against shell containing their own means of ignition. This prejudice—which is not shared by the Navy—would seem to be rather a reflection upon our manufacturing departments.

(*b.*) The distance or mechanical fuze. This fuze, if it could be made to act, would burst the shell to a yard at any required point. But until there shall arise in the Regiment a mechanical genius impervious to official snubs, it must remain a dream of the future.

11. Compare Columns II. and V. of the table. The difference in angle of descent of lowest bullet is 1° 26′, 1° 29′, and 1° 52′, at the three ranges respectively. These angles are too small to make any appreciable difference.

12. If it were required, a Lyddite or gun-cotton burster would tear the tough steel shell into toothpicks. But the nations most advanced in Artillery science, as Italy (and, I believe, Switzerland), have preferred to do away with F.S. common shell altogether. Its uselessness against troops, earthworks, and *matériel* is recognised, and percussion shrapnel, with the bullets set in smoke-ball composition, is found to answer equally well for ranging purposes.

13. The evil effects of this were demonstrated by Colonel Nicholson ("Proceedings," April, 1889), who worked out the formula for the angle of divergence, and proved the scattering effect of the head burster. When, however, in his formula we substitute an increase of velocity of 200 f.s. for a retardation of 133 f.s., we obtain the angles given in Column V., in which the disparity between high and low velocity is much reduced. The H.V. angles are still slightly larger than is desirable (*vide* Column IX.), but a further increase in bullet velocity of 50 f.s. would bring them within the required limits.

To avoid misapprehension, it should be pointed out that the slightly closer shooting of the 1500 f.s. gun, as shown in Columns XII.–XIV., does not argue any greater efficiency. The best effect is produced when the distribution is such as to allow one bullet per man, and when firing at infantry in line this result is usually attained by a burst about 50 yards short. As the L.V. gun shoots 10 per cent. closer than the other it follows that its shell should be burst 10 per cent. further from the target to produce the same effect.

Summary.

Of the five material advantages claimed for high velocity, only one has been established, viz., comparatively deep zone of bullet effect, permitting a considerable error in elevation and in fuze. The importance of this is only fully apparent under service conditions. We cannot expect to fire at a row of white dummies at right angles to the line of fire. A service target will consist of a number of men irregularly disposed over a space of ground, and sure to be more or less on the move. We cannot rely upon a man standing to have his range taken like a dummy with a prop behind. Batteries will range themselves, as they do now on field days, on the most conspicuous object apparently close to the enemy. This may be really hundreds of yards behind him, and the historic instance quoted by Captain White of the Tower of Chlum, shows how difficult it is to avoid this mistake. It is under these circumstances that we come to appreciate the value of a far-reaching shrapnel, which will still be effective if burst 350 yards short of the proper point. If we can succeed in finding the range and fuze within 25 yards, and if the enemy will stand still to be shot at, a low velocity shell will kill him as effectually as a high velocity one; but this is rather more than we have a right to expect on service.

Of the seven points urged in favour of the lower velocity, one only has been fully established. A difference in weight of at least 5 cwt. has been shown to exist. The other points are objections rather to the equipment and ammunition than to the principle of high velocity, and if we accept the supposition of a good recoil carriage, a base burster, and a base fuze, these objections fall to the ground.

Conclusion.

I have no wish to put forward this conclusion as an authoritative one, or as the necessary deduction from the facts. The considerations discussed above will appeal with different force to different minds, and I can only speak for myself.

I think, then, that for Field Artillery the advantage in shooting given by high velocity is too valuable to be thrown away, and I would spare no pains to improve the present indifferent ammunition up to the full power of the gun, 2000 f.s., or even more.

For Horse Artillery, on the other hand, the weight of the high velocity equipment seems a fatal obstacle. Even with the old carriage [1] the present R.H.A. weights are 41 cwt. for the gun and 55 cwt. for the wagon, and the new recoil carriage weighs even more. Moreover, Horse Artillery will probably have more to do with short ranges than Field Artillery, and up to 1500 yards the superiority of the H.V. gun is not very marked. I think, then, that for Horse Artillery the velocity should be reduced to 1500 f.s., bringing the weight behind the team down to 35 cwt., or with mounted limber gunners to 33 cwt.

I have advocated the improvement of our ammunition for the sake of a high velocity gun. But it should be remembered that even a

[1] Field service marching order, two men on the gun and six on the wagon. These weights were obtained from a railway weighbridge, not out of a book.

1500 f.s. gun would be severely handicapped if equipped with ammunition of the present pattern. The Elswick shrapnel, with head burster, has now no excuse for further existence. It was designed before the theory of the "angle of opening" was understood, and under the impression that its good qualities, when burst on graze, would atone for its bad performance when put to its legitimate use. Now, however, Colonel Nicholson has exposed the unsoundness of its principle, and Okehampton experience has shown us that percussion shell can never hope to compete with time shrapnel.

Much might be written about the present fuzes and common shell—much again about a 20-pr. field gun with a low "$\frac{d^2}{w}$" which would keep up its velocity better than the 12-pr.—but this paper is already a long one, and I will say no more.

TRIMULGHERRY,
19th March, 1892.

SIR HENRY SHERE, Kt.

BY

CHARLES DALTON, Esqre., F.R.G.S.

Son of a Deptford sea-captain. Scholar and scientific officer; engineer and artillerist. Was employed at Tangier, from 1669 to 1683, as surveyor and constructor of fortifications. His plan and report on Sir Hugh Cholmley's famous Mole at Tangier is still in existence (Tangier State Papers, 10 March, 1669–1670). Was engaged in various operations against the Moors, particularly in the sanguinary action of 24 October, 1680, on which occasion Sir Palmes Fairborne, the Governor of Tangier, received a mortal wound, of which he died three days after. This event is graphically related in Shere's MS. Diary (Tangier State Papers, No. 30). On the evacuation of Tangier, in the autumn of 1683, Shere was employed under Colonel George Legge (1st Lord Dartmouth) in demolishing the Mole, and the several batteries which he had caused to be erected (Dartmouth MSS., which contain several of Shere's letters from Tangier). On 15 June, 1685, a commission was signed, by James II., appointing "Henry Shere, Esq^re., to be Comptroller of Our Train of Artillery for this present expedition in opposing the traitorous practises and attempts of those Rebells who are now openly in arms against us." The above Train was got ready at Portsmouth 16 June, 1685 ("Cleaveland Notes," p. 99). Nicholas Sandford was appointed Commissary to this Train—his Commission bearing date 15 June, 1685.

At the battle of Sedgemoor it is on record ("Life of the Duke of Monmouth," by George Roberts) that Peter Mews, Bishop of Winchester, assisted Shere to work his guns, and in the list of commanders on the King's side, at this battle (Roberts, vol. II.), the Bishop's name is bracketted with Henry Shere, as joint commanders of the Artillery Train! Nor is this at all strange when we remember that Bishop Mews fought on the Royalist side in the Great Civil War (like Compton, Bishop of London) before entering the Church. Macaulay also tells us that the Bishop of Winchester lent his coach horses and traces to drag the heavy guns into position at Sedgemoor.

Shere was Knighted 20 July, 1685 ("London Gazette"), and appointed Surveyor of the Ordnance, by Royal Grant, 25 September, in same year; Lieut.-General of a Train of Artillery in November, 1688; is said to have translated "Polybius." Was living in 1696.

31st March, 1892.

ABSTRACT OF THE PROCEEDINGS

OF THE

FIFTY-FIFTH ANNUAL GENERAL MEETING

OF THE

ROYAL ARTILLERY INSTITUTION.

The Annual General Meeting was held on the 10th June, 1892, at the Lecture Room of the Institution of Civil Engineers, 25, Great George Street, Westminster.

Lieut.-General R. J. Hay, C.B., Director of Artillery, took the Chair.

Among others present were Major-Generals E. Markham and W. Stirling, C.B.; Colonels J. B. Richardson, C. C. Trench, W. S. Curzon, G. J. Burgmann, and A. Burton-Brown; Lieut.-Colonels. D. F. Jones, F. W. J. Barker, J. F. Harman, E. H. Holley, and E. Bainbridge.

Chairman—I have only to express my regret in the first instance that Sir Robert Biddulph was not able to be here to preside; he could not arrange to be here to-day as he had a pressing engagement elsewhere. As possibly most of you may have read the Report, and as it is so very full it is needless for me to make any comment on it. It appears that the Institution is in a flourishing condition, and that the resolutions that were passed last year have been carried out, not in their entirety, but to a great extent. I think it is only necessary for me to say what I propose to do, that is first of all to invite the Secretary to read the Report, unless it is the wish of the Meeting that it should be taken as read, and then it will be for me to put to you the propositions submitted by the Committee. After that I shall invite any gentleman to offer any remarks he may have to make. Perhaps Captain Abdy will be good enough to read the Report.

Captain Abdy read the following Report.

In presenting their Report for the past year the Committee wish to make a few remarks on the subjects that have been engaging their attention, and before doing so they are glad to be able to report that there has been an unusually large accession of members to the Institution and further that several officers who had allowed their membership to lapse have rejoined the Institution.

The first subject that they would note is that of "Corresponding Members."

It will be remembered that near the end of the year 1890–91 a letter was sent to every C.R.A. at Home or Abroad asking him to arrange for an officer of his command to act as Corresponding Member.

These letters resulted in the appointment of 23 officers, of whom 12 have forwarded matter for publication or suggestions for the improvement or benefit of the Institution.

The Committee consider that the working of the system has been so far satis-

factory, and hope that it may be further developed; with this view they bring forward proposition (No. 1) which will be presently laid before the meeting.

The meeting will doubtless notice that the Committee as it now stands for ratification consists no longer solely of officers stationed at Woolwich; besides those appointed to fill vacancies the opportunity was taken of retaining on the Committee for their full period of three years two officers ordered away from Woolwich; they were anxious to remain on the Committee and were thoroughly conversant with the work.

The subject noted in proposition (No. 2) is one that the Committee feel necessary to bring before a General Meeting; for as the Rules now stand an officer might, by simply posting a notice on the Board at the Institution and securing a following of members to vote on his side, carry a Resolution that would be highly detrimental to the Institution.

During last summer a new roof was put on the chief part of the Institution building and on opening out the Museum it was found that but little damage had been done to the specimens; it is found that the stands and cases are so close to one another that the Committee wish to extend the Museum; the only room available for this is that now told off as a chemical laboratory, and in proposition (No. 3) the meeting will be asked to sanction its removal. The Committee felt that, as the provision of chemical apparatus, tests, &c., was one of the original objects of the Institution, it was not in their power to carry out this change without the sanction of the General Meeting.

With the provision of an adequate laboratory at the Artillery College the necessity for a private one in the Institution has disappeared.

As to the fourth proposition the Committee merely wish to say that at present there are only 8 Special Honorary Members, 20 being allowed by the Rules; and that if the meeting elects these distinguished gentlemen it will honour the Institution by so doing.

The Committee would like to remind the General Meeting that they are most anxious to extend the Library and in order to do this they have asked for suggestions as to books recommended for purchase. They are glad to be able to state that officers at out-stations are beginning to borrow books much more freely and to appreciate this particular benefit of Membership of the Institution.

Reference to the accounts will show a somewhat large expenditure on bookbinding and purchase of books; the Committee report that the Institution has now a very good collection of Ruskin's works, and that by the purchase of seven volumes of Gould's works for £111, and the binding of four other volumes for £20, it now possesses a complete edition of Gould's works value £1000.

The new edition of "Kane's List" has been published since the 1st April, 1891; the Committee had some 25 copies not subscribed for, these they priced at £1 each and had no difficulty in selling. They hope to publish each year a set of Addenda and Corrigenda; those for the present year will be ready shortly.

During the past year a series of pictures representing changes in the uniform of Officers R.A. from 1650 to date and of Officers R.H.A. from 1793 to date have been most carefully prepared by a member. He has studied every possible authority or picture on the subject, and has produced a work which may be relied on for accuracy of detail; his most kind offer of the use of these pictures to the Institution for preparing Plates has been gratefully accepted.

The Committee have been most fortunate in having received some valuable presents during the past year. Two of these deserve special mention, the first is a fine oil picture of Major Jas. Wightman, who was a Sergeant and Sergeant-Major of R.H.A. through the Peninsular War, and laid the gun at Salamanca that shot off Marmont's arm: he was afterwards Sergeant-Major of Horse Artillery at Waterloo, where he himself lost an arm. The picture, believed to be by Landseer when a student, was presented by Major Wightman,

late 11th Hussars, his son, and is hung in the Reading Room of the Institution.

The other present is the complete set of medals and decorations of the late Colonel Sir W. Robe, K.C.B., K.H., R.A., and of his son, Lieutenant W. L. Robe, R.H.A.; it consists of eight items, medals, crosses, and stars, complete with ribbons and clasps; this fine collection is presented to the Institution by Miss Vimiera Robe, last surviving member of Sir William's family, in the hope that the Regiment will take the place of the family in guarding it.

The Committee have had brought to their notice the existence of pictures of two Artillery worthies, namely, General Brome and William Sturgeon; of the former there are three known portraits, and from one of them the Committee propose to have a miniature made; of Sturgeon there is known to be a portrait in the North of England, and of it the Committee hope some day to be able to secure a copy.

The Committee desire to form a collection of original drawings by present and past R.A. Officers, as well as any others of regimental interest, and propose to invite attention to this subject in the "Proceedings."

The number of officers receiving assistance in the study of foreign languages has been few, and in each case the Committee have granted the maximum assistance; the languages for which officers are receiving assistance are Turkish, Russian, and Spanish.

A subject on which a good deal was said at the last Annual Meeting was that of providing information from time to time of progress in the manufacturing and experimental departments so far as they affect Artillery; the Committee have given the subject much attention and regret that they are unable to do anything in the matter.

The Committee have had their attention called to large sheet calendars issued yearly by certain Regiments, and they are now considering the best way of pnblishing one for the Regiment; at present they are of opinion that it should be about the size of the Monthly Lists to be hung on the wall near and for reference to the tabular "Changes in the R.A." and "War Services of the Royal Regiment of Artillery."

In the matter of the "Proceedings," the Committee are glad to be able to state that the numbers of Papers sent in for publication seems to be on the increase and this without any decrease of style or quality.

There are on the 31st March, 1892, 1753 Members of the Institution against 1669 last year. 127 Officers joined during the year against 59 last year; whilst deaths and withdrawals amounted to 44.

The number of deaths was 14. Among them are to be noted the names of the following Officers:—

Major-General G. Davis, V.C., Major-General F. Dick; Colonel W. Keith, R.E.; Major F. Beaufort, Major W. J. Robertson; Captain W. M. Russell; Lieutenant J. Haggard and Lieutenant G. C. Bayly (h.p.)

The accounts have again this year been audited by Messrs. Agar and Bates, Chartered Accountants.

Appendix A shows the Expenditure and Income.

Appendix B shows the financial condition of the Institution.

The General Credit shown in the Balance Sheet is £3577, against £3326 last year. The Liabilities are £286, of which £29 belongs to the Haggard Memorial Fund.

The R.A. Institution and the Observatory are insured for £11,000 and £1000 respectively in the Sun Insurance Company. The premiums are paid direct by Messrs. Cox & Co.

The subject for the "Duncan" Gold Medal of the year was, "Fire Discipline; its necessity in a Battery of Horse or Field Artillery, and the best means of securing it."

20 Essays were submitted for competition. Colonel T. B. Tyler, Lieut.-Colonel C. H. Spragge and Lieut.-Colonel G. H. Marshall were good enough to act as judges.

The judges have not quite completed their report; this is due to the large number of essays submitted and the fact that the judges have not been able to meet and consult.

CHAIRMAN—In consequence of this, I propose that we empower the Committee and Secretary to act on the report of the Judges as soon as it be received, and open the sealed envelopes containing the names of the Officers who have written the various prize and commended essays.

This was agreed to by the Meeting.

Lieut.-Colonel E. S. B. Lockyer, Major J. R. J. Jocelyn and Captain J. M. Grierson kindly consented to act as Judges for the Rewards.

The writers of the following papers are recommended for Rewards opposite their names :—

"The R.A. Mess at Woolwich" and "The World's Warships," and in acknowledgment of his frequent and very interesting communications	By the *late* Major W. J. Robertson, R.A.—to his Widow ...	£10
"Master-Gunners of England," and in acknowledgment of his valuable contributions to the history of the Regiment	„ Major R. H. Murdoch, R.A.	£5
"The Miranzai Expedition, 1891"	„ Lieut. L. C. Gordon, R.A.	£5
"Steel as Applied to Armour." ...	„ Lieut. J. H. Mansell, R.A.	£3
"The Battle of Lützen" and other contributions	„ Lt.-Col. J. C. Dalton, R.A.	£3
"Shrapnel Fire."	„ Major G. S. Clarke, C.M.G., R.E. ...	£2
"The French Manœuvres of 1891"	„ Capt. J. F. Manifold, R.H.A.	£2
"Etudes de Tactique" (Translation)	„ Capt. T. E. Carte, R.A.	£5
Numerous Translations	„ Lieut.-Col. F. E. B. Loraine, *late* R.A.	£5
The Artillery Combat in Siege Warfare" (Translation)	„ Lieut.-Col. J. H. G. Browne, *late* R.A.	£3
"Mounted Infantry Detachments :" A Review	„ Major E. S. May, R.A.	£2
For interesting communications from this Station's "Corresponding Member," suggested to present some memento	To R.A. Mess, Halifax ...	£5

The Judges wish to state that they do not attempt to select "the best papers," as laid down in the "Rules for Rewards"; the contributions are of such a varied character that they consider such a selection would be almost impossible; they have tried to select those for Reward according to their interest and value generally to the Members of the Institution.

The following changes in the Committee took place during the year:—

Lieut.-Colonel J. C. Dalton,	vice	Major J. F. Bally.
Major H. C. Sclater,	„	Major W. F. L. Lindsay.
Colonel J. B. Richardson,	„	Lieut.-Colonel L. Downes.
Captain J. M. Grierson,	„	Major R. L. Haines.
„ H. J. DuCane,	„	Captain H. S. le M. Guille.
„ A. Crawford,	„	Major W. E. Blewitt.
Lieut. A. H. Lee,	„	„ G. H. Bittleston.

The Committee is now constituted as follows:—

PATRON AND PRESIDENT:

Field Marshal H.R.H. the Duke of Cambridge, K.G.

VICE-PRESIDENTS:

The Director of Artillery.
The Deputy-Adjutant-General, R.A.
The General Officer Commanding Woolwich District.

MEMBERS:

The Assistant-Adjutant-General, R.A.
The Director, Artillery College.
The Assistant-Adjutant-General, Woolwich.
The Secretary, Ordnance Committee.

Colonel J. B. Richardson.	Major H. C. Sclater.
„ W. S. Curzon.	„ E. S. May.
„ H. de S. Isaacson.	„ T. H. E. Acton.
Lt.-Col. C. H. Spragge.	Capt. J. M. Grierson.
„ J. C. Dalton.	„ H. J. DuCane.
Major A. W. Anstruther.	„ A. Crawford.
„ E. M. Baker.	Lieut. A. H. Lee.
„ W. F. Cleeve.	

Bankers:

Messrs. Cox & Co., and London and County Bank.

Solicitor:

E. W. Sampson, Esq., Woolwich.

TRUSTEES:

General Sir C. Dickson, V.C., G.C.B.
„ Sir H. A. Smyth, K.C.M.G.
Lieut.-General R. P. Radcliffe.

Secretary.—Capt. A. J. Abdy.

The constitution of the Committee as above was approved by the Meeting.

The following Propositions were then brought before the Meeting and carried in the form in which they now stand.

(1.) That the Committee remain as now constituted; that all Corresponding Members be extra members of the Committee, having a vote when they attend meetings of the Committee; that notice of all Committee Meetings be sent to Corresponding Members, either on home service or on leave at home from abroad.

(2) That all proposed changes of the Rules should be notified in R.A.I. "Proceedings" in, what seems to the Committee, sufficient time before the General Meeting to which such changes are to be submitted to enable Members to form their views on them.

Consequently, that Rule XX. be as follows :—

XX. No alterations or additions to be made to these Rules, unless a notice in writing, specifying the alteration or addition to be proposed, shall have been posted on the Notice Board at the Institution for fourteen days previous to the General Meeting and unless the alteration or addition shall have been published in the Notes of the R.A.I. "Proceedings" in, what seems to the Committee, sufficient time before the General Meeting, such time to be not less than one clear month.

(3.) That sanction be given for the removal from the Laboratory in the Institution building of all the furnaces and other fittings, and for the sale of chemicals therein with a view to extending the Museum.

(4.) Lieutenant-General Sir H. Evelyn Wood, V.C., G.C.B., G.C.M.G., Commanding Aldershot District, and

W. Anderson, Esq., M.Inst.C.E., D.C.L., F.R.S., Director-General of Ordnance Factories, were elected Special Honorary Members.

The Report, including Accounts and Appendices, was adopted.

Seven subjects proposed for the Gold Medal Prize Essay, 1893, were considered in detail, and of them two were chosen to be submitted to H.R.H. the Commander-in-Chief with a view to his selection of one; when approved the subject will be published in Notes of the R.A.I. "Proceedings" from time to time, to keep it in the mind of intending Competitors.

The business connected with the Institution being concluded, the presentation of the Lefroy Medal and consideration of the R.A. Charities took place as reported elsewhere. The CHAIRMAN said: I would propose a vote of thanks to the Institution of Civil Engineers for having lent us this Theatre for the Meeting on this occasion. (Hear, hear.) Many of us have attended Meetings of the greatest interest in this Institution, and it is a good sign of the times, I think, their coming forward in this way to lend us their Theatre. (Applause). I may further tell you that they have been kind enough to provide refreshments below for anyone attending the Meeting who wishes to accept their hospitality. (Applause.)

This was carried with acclamation, as was a vote of thanks to LIEUT.-GENERAL R. J. HAY, C.B., for taking the chair, proposed by MAJOR-GENERAL E. MARKHAM and seconded by COLONEL W. S. CURZON.

ACCOUNTS O

EXPENDITURE.

		£
Printing etc.	Wages—Compositors, &c.	1
	Printing Accounts	1
	Folding, Stitching, &c.	1
	Printing Materials	2
	Wood Engraving and Lithography	1
Classes		
Lectures		
Library and Books for sale		
Museum		
Observatory		
Carpentry	Wages	
	Materials	
Stationery		
Postage and Parcels		
Clerks and Orderlies	Wages	1
	Clothing	
Subscriptions to Societies		
Fire Insurance		
Washing and Cleaning		
Subscriptions refunded		
Collecting Woolwich Bills, £3; Christmas Boxes, 7s. 6d.		
Cost of Transferring Consols to new Trustees		
Medals, Honoraria and Rewards		

Balance—Being surplus of income for the year ended 31st M

DR. LIABILITIES, &c.

		£
To Sundry Creditors, viz.:	Accounts for Printing, goods, &c., owing by the Institution	
	Amount to Credit of Members on current Accounts	
"	Members' Subscriptions paid in advance	
"	Lefroy Portrait Fund—	
	Amount at credit 31st March, 1891	
	Less payments made	
"	Haggard Memorial Fund—	
	Amount received to date	
"	Borgard Memorial Fund—	
	Amount to credit 31st March, 1891	1
	Disposed of by donation £105 to Royal School for Daughters of Officers, and Expenses £2 2s. 6d.	1
"	Balance, being Surplus of Assets in this Balance She March, 1892, viz.:	
Surplus at 31st March, 1891		
Additional.—Surplus of Income for the Year ended 31st March, 1892, as per Expenditure and Income Account		

N.B.—This Surplus is in addition to the value of the co Museum and Library, Instruments, Furniture, Fixtures, & to the Institution, which the Committee have estimated at which are insured for that sum in the Sun Fire Office.

We have compared the foregoing Balance Sheet, and E and certify the same to be correct. We have tested por the certificate received from the Bank of England.

LONDON, 12*th May*, 1892.

APPENDIX A.

GENERAL ABSTRACT

OF THE

ACCOUNTS OF THE ROYAL ARTILLERY INSTITUTION,

From 1 April, 1891, to 31 March, 1892.

EXPENDITURE AND INCOME.

EXPENDITURE.

	£	s.	d.	£	s.	d.
Printing etc.: Wages—Compositors, &c.	113	12	7			
Printing Accounts	199	6	7			
Folding, Stitching, &c.	126	6	8	781	2	2
Printing Materials	225	9	10			
Wood Engraving and Lithography	116	6	6			
Classes				28	19	4
Lectures				17	12	8
Library and Books for sale				463	6	3
Museum				34	4	0
Observatory				20	12	6
Carpentry: Wages	25	9	4	76	16	11
Carpentry: Materials	51	7	7			
Stationery				4	18	1
Postage and Parcels				71	8	2
Clerks and Orderlies: Wages	136	13	10	149	13	10
Clerks and Orderlies: Clothing	13	0	0			
Subscriptions to Societies				3	3	0
Fire Insurance				30	3	6
Washing and Cleaning				27	1	2
Subscriptions refunded				16	4	0
Collecting Woolwich Bills, £3; Christmas Boxes, 7s. 6d.				3	7	6
Cost of Transferring Consols to new Trustees				2	0	6
Medals, Honoraria and Rewards				77	6	6
				1808	0	1
Balance—Being surplus of income for the year ended 31st March, 1892				251	0	11
				£2059	1	0

INCOME.

	£	s.	d.	£	s.	d.
Amounts charged to Members for: Printing	142	10	4			
Classes	0	6	0			
Books, &c.	218	11	9	394	6	1
Stationery	0	9	2			
Postage and Parcels	31	15	0			
Carpentry	0	19	10			
Subscriptions and Entrance fees for 1891–92: Entrance Fees received	129	0	0			
Subscriptions—Received £1393 14 0				1562	12	6
Subscriptions—Outstanding 39 18 6	1433	12	6			
Arrears of Subscriptions received				13	2	0
Borgard Fund for expenses				2	2	5
Dividends for a year on £3240 13s. 11d. 2¾ per cent. Consols, less Income Tax				86	18	0
				£2059	1	0

APPENDIX B.

BALANCE SHEET.—31st March, 1892.

DR. LIABILITIES, &c.

	£	s.	d.	£	s.	d.
To Sundry Creditors, viz.: Accounts for Printing, goods, &c., owing by the Institution	228	15	0			
Amount to Credit of Members on current Accounts	9	1	4	237	16	4
" Members' Subscriptions paid in advance				19	1	6
" Lefroy Portrait Fund—Amount at credit 31st March, 1891	15	7	0			
Less payments made	14	3	0	1	4	0
" Haggard Memorial Fund—Amount received to date				28	15	6
" Borgard Memorial Fund—Amount to credit 31st March, 1891	107	2	5			
Disposed of by donation £105 to Royal School for Daughters of Officers, and Expenses £2 2s. 6d.	107	2	5			
				286	17	4
" Balance, being Surplus of Assets in this Balance Sheet at 31st March, 1892, viz.:				3577	13	0
Surplus at 31st March, 1891				3326	12	1
Additional.—Surplus of Income for the Year ended 31st March, 1892, as per Expenditure and Income Account				251	0	11
				£3577	13	0

N.B.—This Surplus is in addition to the value of the contents of the Museum and Library, Instruments, Furniture, Fixtures, &c., belonging to the Institution, which the Committee have estimated at £11,000, and which are insured for that sum in the Sun Fire Office.

				£3864	10	4

CR. ASSETS.

	£	s.	d.	£	s.	d.
By Cash in hand and at Bankers				430	0	10
" Sundry Debtors, viz.: Amount owing by Members on current Accounts	114	1	9			
Amount owing by Members for entrance fees and subscriptions	56	1	6	170	3	3
" Stocks on hand, viz.: Printing paper	34	0	6			
Books for sale	37	17	7	71	18	1
" Investments, viz.: £3240 13s. 11d. 2¾ per cent. Consols at				3192	8	2
In Balance Sheet of 31st March, 1891:—£3152 10s. 11d. Consols at	3101	10	2			
Taken over from Borgard Fund:—£88 3s. Consols at	90	18	0			
	£3240	13	11	£3192	8	2

				£3864	10	4

AUDITORS' CERTIFICATE.

We have compared the foregoing Balance Sheet, and Expenditure and Income Account, with the Monthly Cash Accounts, audited by the Committee, and the books of the Institution, and certify the same to be correct. We have tested portions of the Cash and Ledger Accounts with the Vouchers and Daily Cash Book, and have verified the Investments with the certificate received from the Bank of England.

LONDON, 12*th May*, 1892.

AGAR & BATES, Chartered Accountants.

APPENDIX C.

Statement shewing Increase and Decrease of Members of the Institution during the year ending 31st March, 1892.

Ranks.	1st April, 1891.	Increase.			Total increase.	Decrease.				Total decrease.	Balance.		31st March, 1892.
		Promotions.	Retirements.	New Members.		Promotions.	Retirements.	Withdrawals.	Deaths.		Decrease.	Increase.	
EFFECTIVE LIST.													
Generals and Field Officers	470	42	—	1	43	—	34	1	4	39	—	4	474
Captains	396	79	—	4	83	42	6	3	2	53	—	30	426
Lieutenants... ...	518	—	—	119	119	79	3	1	3	86	—	33	551
Medical Officers ...	2	—	—	—	—	—	—	—	—	—	—	—	2
Veterinary Surgeons	1	—	—	—	—	—	—	—	—	—	—	—	1
Quarter-Masters ...	3	—	—	—	—	—	—	—	—	—	—	—	3
RETIRED LIST.													
Generals and Field Officers	156	—	34	—	34	—	—	19	4	23	—	11	167
Captains	69	—	6	1	7	—	—	4	—	4	—	3	72
Lieutenants... ...	16	—	3	—	3	—	—	2	—	2	—	1	17
Paymaster... ...	1	—	1	—	1	—	—	—	—	—	—	1	2
Riding Master ...	1	—	—	—	—	—	—	—	—	—	—	—	1
Medical Officers ...	2	—	—	—	—	—	—	—	—	—	—	—	2
Chaplain	1	—	—	—	—	—	—	—	—	—	—	—	1
Quarter-Master ...	1	—	—	—	—	—	—	—	—	—	—	—	1
Honorary Members.	32	—	—	2	2	—	—	—	1	1	—	1	33
Totals ...	1669	121	44	127	292	121	43	30	14	208	—	84	1753

APPENDIX D.

Presentations to the Library.

Hand-book for the 2½-pr. Quick-firing Mountain Gun, Nordenfelt	The Maxim Nordenfelt Gun and Ammunition Company.
Smithsonian Miscellaneous Collections :—	
1. A Clinical Study of the Skull	The Council Smithsonian Institution.
2. Index to the Literature of Thermodynamics.....	
3. The Correction of Sextants for Errors of Eccentricity and Graduation.....	
4. Experiments in Aerodynamics	

5. The Toner Lectures, IX. No. 594	The Council Smithsonian Institution.
6. Index to the Literature of Columbium...	
7. Bibliography of the Chemical Influence of Light	
8. Catalogue of Prehistoric Works East of the Rocky Mountains	
9. Omaha and Ponka Letters	
Annual Report of the Board of Regents of the Smithsonian Institution, 1889	
Presidential Address of Sir F. A. Abel, K.C.B., D.C.L., D.Sc., F.R.S., delivered at the Meeting of the Iron and Steel Institute, 6th May, 1891	The Author.
Differential and Integral Calculus, by Professor A. G. Greenhill, M.A., F.R.S.....	The Author.
La Poudre sans Fumée et la Tactique, par G. Moch, Capitaine D'Artillerie. (Two copies)	The Author.
Determination des Vitesses des Projectiles au Moyen des Phénoménes Sonores, par Le Capitaine Gossot, de L'Artillerie de la Marine (Two copies)	The Author.
The Gunner's Pocket-book, by Sergeant-Major A. C. Chew, R.A.	The Author.
The Campaigns in Virginia, 1861–2, by T. M. Maguire, M.A., LL.D.	The Author.
The 66th Berkshire Regiment, 1758–1881, by J. Percy Groves	The Author.
Questions and Answers in Gunnery, by Major F. W. Panzera, R.E.	The Author.
Mahdiism, and the Egyptian Soudan, by Major F. R. Wingate, *D.S.O.*, R.A.....	The Author.
Fortificazione Improvvisata, Attacco E Difesa di Localita E Di Posizione Fortificate, by Pio Spaccamela, Capitano Del Genio.....	The Author.
Arsenals and Armouries of Southern Germany and Austria, Part I., by the Baron de Cosson, F.S.A., F.R.G.S.	The Author.
Hand-book of Artillery Materiél, 5th edition, by Major F. C. Morgan, R.A.	The Author.
Sketch Map of Ground around Masi Kesi.....	The Director of Military Intelligence.
Memoire sur un Nouveau Systéme de Bouches a feu Démontables, par Pierre S. Lygondis	
War Office Catalogue of Maps, Vol. IV.	
Map of the Gambia River, in four sheets, *a*, *b*, *c*, and *d*, No. 848	
Map of part of South East Africa, No. 795...	
Map of Southern Zambesia, sheets I. and II., Nos. 846 and 846[a].....	
Accessions to the War Office Library, No. 9...	
The French Manœuvres, 1891	
Map of Egypt, Eastern Desert, or Northern Etbai, sheets *a*, *b*, and *c*, No. 864.....	
Report on Horse Breeding in Hungary, by Major D. Dawson, Coldstream Guards	
Modern Military Rifles and Carbines.....	

Map of Persia, in six sheets, No. 597	The Director of Military Intelligence.
A General Map of Eastern Equatorial Africa, No. 748	
A Packet of MS. Papers relating to Artillery, dated 1743, and six drawings of guns, &c., at Gibraltar	
Gun-cotton as a Means of Attack on the French "forts d'Arret." (50 copies)	The Secretary, Royal Engineer Institute.
Fortification for English Engineers, by Major J. F. Lewis, R.E.	
Professional Papers of the Corps of Royal Engineers, Vol. XVI.	
Map of Belgium, 3 Vols., sheets 1 to 65	Major-General M. E. C. Stocker, *late* R.A.
Royal Warrant for Pay and Promotion, &c., 1891	The Deputy-Adjutant-General, Royal Artillery.
Dress Regulations for the Army, 1891	
Report on Practice at Okehampton, 1891	
Equipment Regulations, 1891, Part II., Garrison Artillery Details	
Report of Siege Operations at Lydd, 1891	
Hand-book for 80-ton R.M.L. Gun	
Instructions for Siege Artillery Practice for 1892. (Six copies)	
Instructions for Horse, Field, and Mountain Artillery Practice for 1892. (Six copies)	
Approved Arrangements for Coast Defence Instruction and Practice at the Western Forts, Isle of Wight, 1892	
Report on Camp of Instruction, Western Forts, Isle of Wight, 1891	
Notes on the Construction of Ordnance, Nos. 57, 58, and 59	The Chief of Ordnance, U.S.A.
Annual Report of the Chief of Ordnance, United States, 1890 and 1891	
Ordnance and Gunnery, United States Military Academy	
Tests of Metals, &c., 1890	
Report of the Astronomer Royal, to the Board of Visitors of the Royal Observatory, Greenwich, 1891	The Astronomer Royal.
Proceedings of the Institution of Civil Engineers, Vols. 104, 105, 106, and 107	The Council of the Institution of Civil Engineers.
Engineering Education in the British Dominions	
List of Members, Bye-Laws, Charter, &c., of the Institution of Civil Engineers	
Cuningham on the Proposed Railway through Siberia	
Journal of the Iron and Steel Institute, No. 1, 1891	The Council.
The Archæological Journal, Nos. 187, 188, 189, 190, 191, and 192	The Council.
Journal of the United Service Institution of Victoria, Vol. I., 1890–91	The Council.

A Complete Set of the War Game, "Polemos," 3rd edition	Lieut.-Colonel F. F. Ditmas, R.A.
War Office Photographs, Nos. 7492, 7493, 7494, 7669, 7670, 7695, 7701, 7702, 7703, and 7704	The Secretary of State for War.
Lithographs: R.C.D., Nos. 182, 183, 184, 185, 186, 187, and 188	
Lithographs: R.G.F., 141	
Lithographs: R.L., 205, 206, 207, 208, 209, 210, and 211	
Extracts from the Annual Report of the President of the Ordnance Committee, 1890. (Six copies)	
Queen's Regulations and Orders for the Army, 1892	
The Russian and Roumanian Frontier of Austria-Hungary, 2nd edition	
Modern Naval Artillery	Sir W. G. Armstrong & Co.
Manuale D'Artiglieria, Part III.	Italian Government.
Examination Papers for the Auxiliary Artillery, November, 1891	The Director-General of Military Education.
Report on the Final Examination, held at the Staff College, December, 1891	
Report of the Examination for Admission to the Staff College, May, 1891	
L'Armée Ottomane, Contemporaine, par Ch. Le Brun-Renaud	Major H. C. C. D. Simpson, R.A.
Tables of Small Arms; Swords and Lances; Small Arm and Machine Gun Ammunition; and Machine Guns in use in the British Service	The Director of Artillery.
Catalogue of the Rotunda Museum, 1822	
The German Field Artillery Equipment, 1890. (Two copies)	
General Information Series, No. 10. A Year's Naval Progress	The Secretary U.S. Navy.
Standing Orders of the Brigade of Horse Artillery (Bombay), 1829	Colonel F. W. M. Spring, R.A.
Bombay Artillery Standing Orders, 1844	
Gentleman Cadet's Warrant, framed in Oak and Gold	Major J. P. Groves.
Examination Papers, Royal Military Academy, July, 1891	The Governor, R.M. Academy.
Ambulance Organisation, Equipment and Transport, for the Mounted Services	The Secretary, U.S. Institution of N.S. Wales.
An Impartial History of the Naval, Military, and Political Events in Europe, from the French Revolution to the entry of the Allies in Paris, 3 Vols.	Lieutenant R. J. Macdonald, R.A.
Bulletins of the Campaign of 1794	T. Hyde Drake, Esq.
Platinotype Copy of a Portrait of General John Godwin, as a Captain R.A. who Commanded the R.A. at the Siege of Gibraltar	Colonel C. E. S. Scott, R.A.
Netherlands Artillery Atlas, Plates Nos. 198 to 203	Netherlands Government.

Exercises for the Horse, Dragoon, and Foot Forces. Dublin, 1728	Major H. C. M. Woods, R.A.
Portrait in Oils of the late Lieutenant James Wightman, R.A., as a Sergeant-Major R.H.A., painted in 1821, in massive gilt frame	Major J. T. Wightman, *late* 11th Hussars.
Standing Orders of "E" Troop R.H.A., dated 1808	
Views of the Mauritius and the Persian Gulf, by R. Temple	Major-General J. B. Dennis, *late* R.A.

APPENDIX E.

Books, &c., Purchased.

Lettres sur la Poudre sans Fumee et les Methodes de Guerre.
Traite des Fonctions Elliptiques et de Leurs Applications. Part III.
Carnet de L'Officer de Marine. 1891.
Le Gyroscope, La Toupie et le Projectile Oblong.
Geographie Militaire. Par le Lieut.-Colonel Niox. 8 Vols.
La Nation Armée, Organisation Militaire et Methodes de Guerre Modernes.
Elementary Practical Physics. By Stewart and Gee. 2 Vols.
The Land of the Lion and the Sun, or Modern Persia.
Des Canons a fils d'Acier. Par G. Moch.
Etudes Pratiques de Guerre. Par General Lamiraux.
Schlachten Atlas. Parts 30 and 31.
Memoirs du General Baron de Marbot. 3 Vols.
Notices Historiques sur L'Etat-Major-General. Par Leon Hennet.
Moltke's Militaritche Korrespondenz, Krieg 1864.
L'Artillerie de Campaigne en Liaison Avec les Autres Armes. Par le Colonel Langlois. 2 Vols.
Guerre D'Espagne, Extrait des Souvenirs Inédits du Général Jomini, 1804–1814. Par Ferdinand Lecomte.
La Défense des Frontieres de la France. Par le General Pierron. Tome I.
Arundel Society's Publications.
Five Heliogravures, after the frescoes by Romanino in the Castle of Malpaga near Bergamo, entitled—

1. The Arrival of King Christian of Denmark.
2. The Tournament.
3. The Banquet.
4. The Distribution of Liveries.
5. The Departure of King Christian.

The Life of Bartolomeo Colleoni of Anjou and Burgundy, by Oscar Browing.
St. Peter Enthroned as Pontiff, from the picture by Gran Vascoe, at Vizeu, near Oporto, Portugal.
Biologia Centrali-Americana, Zoology, Parts 93–101.
Biologia Centrali-Americana, Archæology. Part 3. Text and Plates.
Untrodden Ground in Astronomy and Geology. By Major-General A. W. Drayson, *late* R.A.
The Queen's Commission. By Captain G. J. Younghusband.
Elements of Metallurgy. By J. A. Phillips and H. Bauerman. 1 Vol. 1891.
The Artillery of the Future, and the New Powders. By J. A. Longridge.
War, Reproduced with amendments from the "Encyclopædia Brittanica." By Colonel J. F. Maurice, C.B., R.A.

The Indian Mutiny. By Colonel G. B. Malleson, C.S.I.
Higher Algebra. A Sequel to Elementary Algebra for Schools.
The Afghan War of 1879–80. By Howard Hensman.
Battles and Leaders of the Civil War in America. 4 Vols.
Waterloo Letters.. By Major-General H. T. Siborne, *late* R.E.
Life and Times of General Sir Edward Cecil, Viscount Wimbledon. By C. Dalton, F.R.G.S. 2 Vols.
The Development of Navies. By Captain S. Eardley-Wilmot, R.N.
The Siege of Lucknow. A Diary. By the Honourable Lady Inglis.
The Battle of Spicheren. By Major G. F. R. Henderson.
Field Fortification. By H. Turner, *late* R.A.
Smokeless Powder, and its Influence on Gun Construction. By J. A. Longridge.
Modern French Artillery. By James Dredge.
The Ibis. Nos. 11 and 12. Vol. III. Sixth series.
Notes on Naval Guns, their Stores and Fittings.
Notes on Explosives. By Dr. W. R. Hodgkinson.
Notes on Electricity, compiled for the use of N.C. Officers, Telegraph Battalion, Royal Engineers.
Instructions in Military Engineering. Vol. I. Parts 2, 3, 4, and 5.
Notes on Electricity for Garrison Artillery. By Major J. R. J. Jocelyn, R.A.
Field Army Establishments. Service Abroad. 1891.
The India List, Civil and Military. 1891.
Royal Atlas of Modern Geography. Parts 1 to 7.
Three Sets of Interchangeable War Game Maps.
Historical Record of Medals and Honorary Distinctions conferred on the British Army, Navy, and Auxiliary Forces, from the Earliest Period. By George Tancred (*late*) Captain Royal Scots Greys.
Monograph of the Paradiseidæ, or Birds of Paradise, and Ptilonorhynchidæ, or Bower Birds. By R. Bowdler Sharpe, LL.D., &c. Part I.
The Mammals of Australia. Vols. I., II., and III.
Monographs of Toucans, Trogons, and Partridges of America. 1 Vol. of each.
Game Birds and Shooting Sketches. By J. G. Millais, F.Z.S., &c.
India Army Regulations. Vol. I., Part I., and Vol. II., with corrections.
The Quarterly Indian Army List, 1st January, 1892.
Regulations for the Royal Artillery in India. 1891.
Report of the Committee appointed by the Secretary of State for War to consider the Terms and Conditions of Service in the Army.
Minutes of Evidence taken before the Committee appointed by the Secretary of State for War to consider the Terms and Conditions of Service in the Army.

APPENDIX F.

Presentations to the Museum.

Two Head-dresses, of the Macusi Indians, British Guiana ..... Eleven Skins of Various Birds from Guiana...	Mr. H. Whitely, Junr., C.M.Z.S.
Aptenodytes Penantii, or Penguin, from Falkland Island, stuffed, in glass case	Mr. H. Whitely, Senr.
A Burmese "Jingal" and "Matchlock".....	Major Sorell.
Nineteen British and Foreign Medals and Decorations.....	Lieut.-Colonel N. L. Walford, R.A.
5 Hard Wood Shells of Various Shapes and Sizes, found in an old disused Well, at Ahmednugger	Surgeon-Lieut.-Colonel H. J. Waller-Barrow, A.M.S.

APPENDIX G.

List of Papers published in the "Proceedings" during the Year.

Imperial Federation and the Defence of the Empire. By G. R. Parkin, Esq., M.A. (*Re-printed by permission of the Aldershot Military Society*).

Some of the More Recent Developments and Applications of Explosives. A Lecture. By Colonel V. D. Majendie, C.B., H.M.'s Chief Inspector of Explosives.

The R.A. Mess at Woolwich. By Major W. J. Robertson, R.A. (*Continued from page 183, Vol. XVII. Conclusion.*)

Franco-German War. August 2nd, 1870, to February 18th, 1871. A Lecture. By T. M. Maguire, Esq., LL.D., of the Inner Temple, Barrister-at-Law.

Memoir of General Sir John St. George, G.C.B., R.A. By Lieut.-Col. J. C. Dalton (h.p.), R.A.

Recent Armour-Plate Trials. By Captain G. J. F. Talbot, R.A.

Foreign Views upon Questions of Siege and Fortress Warfare. Compiled for the Intelligence Division of the War Office. By Major J. Wolfe Murray, R.A.

Memoir of General Sir John Henry Lefroy, K.C.M.G., C.B., F.R.S., R.A. By Colonel J. F. Maurice, R.A.

Mounted Infantry Detachments. A Review. By Captain E. S. May, R.A.

Some Notes on the Armed Strength of Russia. By Captain E. S. May, R.A.

Proceedings of the Fifty-Fourth Annual General Meeting of the R.A. Institution.

Royal Artillery Charities.

Having Regard to Recent Improvements in *Matériel*, could the Training of the *Personnel* of our Garrison Artillery be further Perfected to Ensure Greater Efficiency. (Silver Medal Prize Essay, 1891). By Lieut.-Colonel R. W. Rainsford-Hannay, R.A.

Competitive Practice for Field Artillery. By Major J. H. Rosseter, R.A.

Experiences at Okehampton in 1890. By Lieut. G. F. Herbert, R.A.

Ranging a Battery: an Amplification of the Bracket System. By Major J. A. Robertson, R.A.

Shrapnel Fire. By Major G. S. Clarke, C.M.G., R.E.

Rules for the Guidance of Section and Fort Commanders in the Selection of Projectiles with which to Attack Foreign Vessels. By Captain E. Nash, R.A. With Introductory Remarks by Colonel J. F. Owen, R.A.

Having Regard to Recent Improvements in *Matériel*, could the Training of the *Personnel* of our Garrison Artillery be further Perfected to ensure Greater Efficiency. (Commended Essay, 1891.) By Captain G. Osborn, R.A.

Suggestions for Improvement of Scott's Telescopic Sight. By Captain H. A. Bethell, R.A.

Promotion of Officers, Royal Artillery, Past and Present. By General Sir John M. Adye, G.C.B., Colonel-Commandant Royal Artillery.

The Battle of Lützen. 16th November, 1632. By Lieut.-Colonel J. C. Dalton (h.p.), R.A., D.-A.-A.-G.

Having Regard to Recent Improvements in *Matériel*, could the Training of the *Personnel* of our Garrison Artillery be further Perfected to Ensure Greater Efficiency. (Commended Essay, 1891). By Captain W. St. P. Bunbury, R.A.

An Artillery Duel. By Lieut.-Colonel D. D. T. O'Callaghan, R.A.

Miranzai Expeditions, 1891. By Lieutenant L. C. Gordon, R.A.

Indirect Laying with the Watkin Range-Finder. By Captain H. A. Bethell, R.A.

Skill-at-Arms. By Lieut.-General Sir W. J. Williams, K.C.B., R.A.

Having Regard to Recent Improvements in *Matériel*, could the Training of the *Personnel* of our Garrison Artillery be further Perfected to Ensure Greater Efficiency. An Essay. By Captain A. C. T. Boileau, R.A.

Berthier Rifle. By Lieut.-Col. W. B. Hemans, *late* R.A.

A Letter to Captain E. Nash, R.A., on his Rules for the Guidance of Section and Fort Commanders in the Selection of Projectiles with which to Attack Foreign Vessels. By Captain H. J. May, R.N.

Ranging a Battery. By Lieut.-Colonel A. D. Anderson, R.A.

The World's War-ships, from a Gunner's point of view. By Major W. J. Robertson, R.A.

Extracts from the Report of the Ordnance Committee on Experiments with Siege Material carried on at Lydd in 1890. Compiled under the direction of Colonel E. Lyons, R.A., Camp Commandant Lydd.

Comparative Trial of Steel-bodied Shrapnel, with Bursters in the Head and Base respectively, carried out at Shoeburyness in 1882–3. By Lieut.-Colonel E. Bainbridge, R.A.

The Cantor Lecture, 1890—William Sturgeon. Communicated by Major R. H. Murdoch, R.A.

The Concentration of Fire from Forts. By Lieut. G. Tyacke, R.A.

On the Range Indicator Dial. By Lieut.-Colonel R. F. Williams, R.A.

Notes of Two Lectures on Field Fortification, delivered at the School of Gunnery, Shoeburyness. By Major Raban, R.E.

The French Manœuvres of 1891. By Captain J. F. Manifold, R.H.A.

Naval Attack of Fortifications. (Lecture delivered at the School of Gunnery, Shoeburyness). By Captain H. J. May, R.N.

Experiences at Okehampton in 1891. (A Lecture delivered at the R.A. Institution, November 4th, 1891). By Captain W. L. White, R.A.

A Retrospect of the Equipment, Services, &c., of the 1st and 2nd Russian Mountain Batteries in the last War. By Major H. C. C. D. Simpson, R.A.

Field Artillery Fire. By Captain W. L. White, R.A. (School of Gunnery Shoeburyness). Chapters I., II., III. and IV. (*To be Continued.*)

An Historical Note regarding the late Lieut. F. Bayly, (h.p.), R.A. By Lieut.-General Sir R. Biddulph, G.C.M.G., C.B., R.A.

On the Motion of Elongated Projectiles. By G. T. Walker, B.A., B.Sc.

Steel as Applied to Armour. By Lieut. J. H. Mansell, R.A.

APPENDIX H.

Précis and Translations published during the Year.

FRANCE...
- "Revue d'Artillerie." The Transport of Parks of Artillery and the Ammunition Supply of Armies. By Lieut.-Col. F. E. B. Loraine, *late* R.A.
- "Revue Militaire de L'Etranger." December 1889, and June 1890. The Artillery Combat in Siege Warfare. By Lieut.-Colonel J. H. G. Browne, *late* R.A.
- "Revue d'Artillerie." Some Thoughts on the Regulation of Field Artillery Fire. By Lieut.-Colonel F. E. B. Loraine, *late* R.A,
- "Revue d'Artillerie,." April, 1891. Comparative Trial in Sweden of Shrapnel Shell with Bursters in Head and Base respectively. By Colonel E. Bainbridge, R.A.
- "Spectateur Militaire." True Field Fortification. By L. Brun. Translated by Lieut.-Colonel F. E. B. Loraine, *late* R.A.
- "Revue d'Artillerie." The Graydon Dynamite Projector. By Lieut.-Colonel F. E. B. Loraine, *late* R.A.
- "Revue d'Artillerie." Fiske's Telemetric and Pointing Instruments. By G. Moch (Capitaine d'artillerie, Adjoint à la Section technique de l'artillerie). Translated by Lieut.-Colonel F. E. B. Loraine, *late* R.A.
- "Revue Militaire de L'Etranger." April, 1891. The Employment of Plunging Fire in the Field. By Lieut.-Colonel J. H. G. Browne, *late* R.A.

SPAIN ...
- "Memorial de Artilleria." January, 1891. Italian Time Fuzes, &c. By Lieut.-Colonel J. C. Dalton (h.p.), R.A., D.-A.-A.-G.

GERMANY
- "Archiv für die Artillerie, &c." February, 1891. Are there no Longer any Uses for Smoke-Giving Powder? By Captain R. M. B. F. Kelly, R.A.

ITALY ...
- "Revista di Artigliera e Genio." An Apparatus for Checking Recoil. By Captain R. M. B. F. Kelly, R.A.

RUSSIA ...
- "Russian Artillery Journal." November, 1890. The Last Days of the Malakhoff. By Captain E. A. Lambart, R.H.A.
- "Russian Artillery Journal." Practice at Snow Parapets. By Capt. E. A. Lambart, R.H.A.
- "Russian Artillery Journal." January, 1891. On the Angular Velocity of Rotation of an Elongated Projectile. By Captain N. Zabúdski, Russian Artillery of the Guard. Translated by Major G. T. Kelaart, R.A.

Etudes de Tactique, etc. Par Le Général Luzeux. Parts II. and III. Translated by Captain T. E. Carte, R.A. *Continued from No. 8, Vol. XVIII.*

APPENDIX I.

LIST

OF

FOREIGN MAGAZINES AND JOURNALS

TAKEN IN BY THE

R. A. INSTITUTION;

WITH THE NAMES OF OFFICERS WHO HAVE UNDERTAKEN TO SUPPLY PRÉCIS AND REVIEWS OF THEIR CONTENTS FROM TIME TO TIME.

COUNTRY.	NAME OF JOURNAL, &c.	TRANSLATOR.
France	Spectateur Militaire	Lt.-Col. F. E. B. Loraine, late R.A.
	Journal des Sciences Militaires.	—
	Revue d'Artillerie	Lt.-Col. F. E. B. Loraine, late R.A.
	Revue Militaire de l'Etranger.	Lt.-Col. J. H. G. Browne, late R.A., and Capt. E. J. Granet.
Spain	Revista Militar Española	Lt.-Col. J. C. Dalton.
	Memorial de Artilleria	" "
Germany	Neue Militärische Blätter	Capt. J. F. Manifold.
	Archiv für die Artillerie-und-Ingenieur-Officiere	Capt. R. M. B. F. Kelly.
	Militär-Wochenblatt	Major E. S. May.
Austria	Organ der Militär-Wissenschaftlichen Vereine	Major T. Perrott.
	Militärische Zeitschrift	—
	Mittheilungen, &c., des Artillerie-und Genie-Wesens	Capt. L. C. M. Blacker.
Italy	Giornali di Artigleria e Genio	Capt. H. de T. Phillips.
	Rivista " " "	Capt. R. M. B. F. Kelly.
Russia	Journal of Artillery	Capt. E. A. Lambart.
	Russki Invalid	" " "
Servia	Journal of Military Science, &c.	—
Sweden	Artilleri-Tidskrift	—

ACHIEVEMENTS OF FIELD ARTILLERY.

BY

MAJOR E. S. MAY, R.A.

In addressing some officers of the Regiment at the practice camp at Delhi last winter, Lord Roberts pointed out that no single record existed in which an account of what Artillery had accomplished could be found, and suggested that some Artillery officer should make good the deficiency. In response to this invitation I have ventured, in all humility, and fully realising my deficiencies, to write these pages. To tell the achievements of an arm whose proud motto is "Everywhere," to examine its performances in all places, at all periods, and in all actions is so vast an undertaking that I confess it seemed at first hopeless for me to attempt it. I was encouraged, however, by the thought that even if my efforts were inadequate I might yet have effected something if I caused others, perhaps better qualified, to read, and at least I would give some who were away from libraries a chance of hearing some details of deeds that are often mentioned but with which the generality of us have no more than a merely nominal acquaintance.

The difficulties which have most hampered me have been the fear of protesting too much, and the uncertainty as to how much of the general course of a battle to relate. Artillery has fought on so many fields, and has so seldom failed to distinguish itself, that, with a little special pleading, instances of its distinction might be indefinitely multiplied. I have, therefore, only adduced such achievements as seemed to leap to the eyes at once, and have only made a claim where I thought the verdict would be unanimously in our favour. Such are occasions on which guns have intervened with decisive effect in the combat, have had a predominant voice in the issue of the day, and have achieved something beyond what is implied by a bald compliance with their recognised duty.

The accounts of battles have been limited so as only to touch upon general events sufficiently to render the part played by the guns intelligible, and to give an idea of the circumstances which called for their employment. If, therefore, sometimes I appear to have overlooked an important incident in a fight, it may be that I have done so deliberately, because it was not connected with the action of guns. Occasionally, also, I have omitted to notice what some may regard as a brilliant feat achieved by artillery from a wish to put forward only what might be considered salient examples.

PART I.

The Era of Frederick.

The value of Artillery is usually stated to lie in the increased range compared to other weapons with which the arm is endowed, and it is obvious that in this respect it enjoys unique advantages. There is,

however, an even more marked superiority of which the arm is possessed, which is to be found in the power it commands of bringing a highly concentrated destructive effect to bear on a given point. Of course, in one sense it is to its long range that this capability of bringing its force to a focus is to be attributed. Especially in these modern days when lines of battle are extended, and the increased deadliness of improved weapons keeps opponents, in the earlier stages of the battle at any rate, widely separated, guns drawn up along the front of a position can often bring their fire to bear on any given point of their enemy's array, without any change of station, and consequent diminution of fire on their part. Here, then, we find one evident form of the power of concentration referred to springing directly from the range of the guns, and increasing, within the limits of human vision, as it is enhanced. This, however, is not the special power of concentration which we would now draw attention to. Even at short ranges guns have the power of delivering a blow in which the force and energy of many shots from the other arms are stored up and combined, and even a single piece possesses this latter characteristic. The fire which sweeps the front of a battery, or of any one of its component parts, is absolutely annihilating, and modern science has now rendered it so, even at comparatively long ranges. Its scope and force compared to that of musketry may now indeed be regarded as is the furious blast of a blow-pipe in relation to the flicker of a naked flame. Artillery fire was ever distinguished by this characteristic, but in our day it is and will be so even to a greater extent than before, because of the improvements, both present and prospective, in the shrapnel shell.

The storm of bullets can now shower down at 3000 yards, as formerly it fell at less than 300, and the stored force of the blow can be directed and released at the proper moment at such a distance as allows of deliberate aim and cool calculation. Formerly, when grape and canister were the projectiles guns chiefly relied on for their effect, short ranges were necessary to enable them to fully develop their destructive powers, and at such ranges, as we shall hope to show, the fire of artillery produced a peculiarly paralyzing or shattering effect on troops subjected to it. The numbing character of its weighty blow has well earned for it the title of "the hammer" in the armoury of weapons which the commander has at his disposal, and it was by means of it that those who have best understood how to adapt means to an end have ever levelled a road to victory through the ranks of their foes. Ever since Artillery has been understood at all, the history of war teaches us that its value has been best appreciated by those to whom the verdict of time has granted the highest reputation as leaders of men, and, moreover, we find that the general principles of those who have best turned guns to account has in all ages been much the same. In other words, when guns have been handled fearlessly, and in an united effort their performances have been at their best, and this has been the case, as we shall draw attention to in a remarkable instance later on, even when fortune rather than foresight has placed them in position.

Bearing these considerations in mind, and remembering, too, that the relative destructiveness of artillery fire has increased rather than diminished of late, it is more usefully than in the interest of mere anti-

quarian research that we may glance at the achievements of the arm, even as far back as the days of the Seven Years' War. In the first place we may learn how massing of guns has ever most developed their effect, and, secondly, we may see that even in those, the primitive days of ammunition, guns constantly produced something more than the merely moral effect with which alone, up to our own day, they are often only credited.

Not but that this latter is in itself of considerable value in war. If men be only defeated, the exact means by which they are beaten matters little. The moral effect with which some people are even too eager to endow the arm will always be left to it, and after all almost every success in battle is due to such an impression. An infantry attack, it is said, will come to a stand-still when 20 per cent. of the advancing force has fallen. 80 per cent. might still therefore go forward unhurt as well as retire backward, and what is it that denies them progress if it be not moral effect? Fanatics, such as the Arabs of the Soudan, or savages with less sensitive organisations than our own, such as the Zulus, have exemplified this, and have rushed on when Europeans, deterred by moral effect, would have hesitated. Thus it is that, even if the actual result of artillery has sometimes not been commensurate with what might have been anticipated, the dread of its power has not been diminished, and its potentialities have replaced its performances.

It is the fear of what may happen as much as that what has actually occurred that holds men spell-bound. The annals of war have more than once related how troops that have unflinchingly supported the most searching fire have given way panic-stricken like a flock of sheep when a perfectly imaginary cry of "a mine!" in their path was raised. The thought of what the effect of a shell bursting in their midst might be similarly appeals forcibly to the emotions of the very bravest soldiers, while, even in the days of solid shot, the picture presented to the imagination by the thought of a ball ploughing its way through a column, scattering destruction to many on its path, is a sufficiently vivid one to be deterrent.

This, however, is but a digression, and in the following pages an attempt will be made to show that when the artillery has been rightly understood, and where its capabilities have been correctly turned to account, the effect which it has produced has been physical as well as moral, and in numerous examples to be culled from the campaigns of the great masters of war, it has decisively influenced the fortunes of the day, not by what is usually meant by the term moral effect alone, but by the moral effect which was the direct outcome of a markedly physical one.

It is not proposed, however, to write anything like a complete history of the achievements of the arm, nor to discuss its rise and developments historically. It will better answer our purpose to consider what has been accomplished since the period when guns became endowed with sufficient mobility to enable them to manœuvre, and co-operate in all the phases of the fight with the other arms, when in fact they developed into Field Artillery from being merely guns of position.

Consequent on the increased mobility of which guns gradually became possessed, a new method of handling them was rendered possible, and accordingly we find that even as far back as the time of Gustavus Adolphus that great leader saw the advantages to be derived from concentrating guns against particular points of the enemy's line, and that he formed great batteries in the very way which our latest tactics advocate. Such a method of employing guns, although in our century it was for a time lost sight of, and has been latterly again revived, is, like many other modern innovations, no new thing. The advantages to be derived from concentrating the fire of many guns on a single point, and the heavy losses that may be inflicted by the arm most capable of destructive effect on the particular part of the enemy's position which is chosen for a target, are sufficiently obvious, and were not likely to have been lost sight of by men who made a study of war. Such a method of employing artillery is in fact only another recognition of the great truth, which underlies all the principles of tactics, namely, the bringing of superior forces to bear on inferior forces of the enemy at the right moment and in the right place.

"Fire is everything, all the rest is nothing," was a saying of Napoleon's, and the application of overwhelming fire effect was, and is so even more in the present day, the equivalent of the shock of numbers. It follows necessarily from this that all leaders who have displayed a genius for war, whatever their original prejudices may have been, have come in time to appreciate the valuable results to be derived from artillery fire, and, if the achievements of the arm in the last century have not always been as great as might have been expected, the result was due, either (usually at the commencement of wars) to the arm not being properly understood, or to the meagre technical knowledge of the time, which was not yet equal to endowing the guns, either with an adequate mobility, or the destructive effect which an improved construction of ammunition and projectiles has since placed at their disposal. The guns of Frederick's time had neither sufficient range nor accuracy to enable them to fire over the heads of the infantry on their side, and they had, therefore, to be posted in such positions in the line of battle as would place them as little as possible in the way of its advance. Convenient room could often only be found at intervals along the front of battle, and the short range of the guns prevented a due co-operation between these batteries.

At the commencement of his career as a General, too, the King was prejudiced against artillery, and chafed at their slowness and lack of manœuvring power, which interfered with the symmetry and precision of his peculiar tactics. He regarded his highly disciplined battalions and squadrons, which responded to his will more readily, with greater favour, and it was only when he shook himself loose from old traditions and formulas that he discovered the value of a weapon he had to a great extent before despised.

At Rossbach he forgot for a moment his preconceived notions concerning an arm which he had much neglected, and allowed it to be handled independently and collectively in a more liberal manner than had been the custom. Just as on the same day he cast aside the forms previously observed, and abolished time-honoured privileges when he

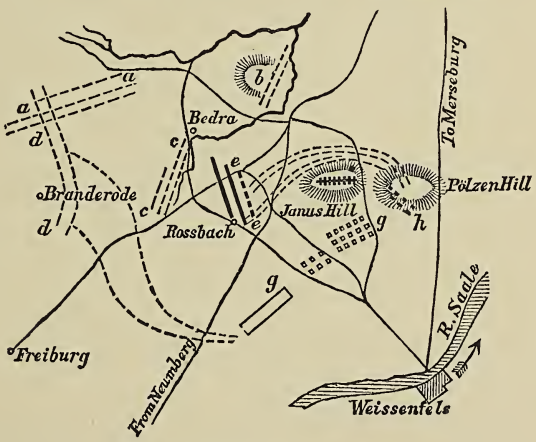
united all his cavalry in one body, and placed the youngest General of the army at its head.

Now-a-days, when a mass of artillery may remain stationary and turn its fire at will on any given point as the tide of battle surges to and fro beneath it, the true method of its employment is rendered comparatively easy, yet it will be found that in spite of the difficulties which the then deficiences of the arm placed in his way Frederick, when converted by its performances to the merits of the arm, aimed at a concentrated effect from his batteries, and directed their fire as far as possible on one point, and that the decisive one. It speaks volumes for the intelligence with which his guns were handled that in spite of the sometimes inevitable separation of the batteries a concentrated effect was frequently produced by their fire, and that in some of his battles, where opportunity offered, his artillery, by judicious handling, were enabled to play a part in the engagement and claim a share of the victory, which raised its status from that of a mere auxiliary arm only capable of a secondary *rôle*, to one of comparative independence and dignity.

We may briefly quote our first example of an artillery achievement from one of the most decisive of battles.

On the 5th of November, 1757, Frederick lay with his left on Rossbach, his right on Bedra. His enemies, the French and the Allies under Soubise, were encamped in greatly superior numbers about two miles from his right wing. That morning they determined to risk an engagement, and conceived the notable project of imitating the King's own tactics and moving round his left to attack him in rear and cut him off from his communications which crossed the river at Weissenfels.

BATTLE OF ROSSBACH; 5th November, 1757.



aa First position of Combined Army.
b First position of Prussian camp.
cc Advance of Prussian Army.
dd Second position of Combined Army.
ee Prussian position at Rossbach.
gg March of Combined army.
h Seydlitz's attack.

The most subtle of Generals early discerned their intention, waited till they were well under way, and then swiftly took ground to his left, wheeled to his left again, and marched rapidly parallel to his opponents, but concealed from view behind the intervening hills. The whole army disappeared in the hollow behind the high ground, and Soubise, fearing that it might escape, hurried on with increased rapidity.

But the Prussians could outmarch their foes, and Seydlitz's scouts from the hill-tops watched and reported on their progress.

When Frederick judged that his cavalry were sufficiently ahead of the enemy's column, he pushed out a battery of 18 12-pr. guns to the Janusberg and suddenly smote the head of their advance with an unexpected and concentrated fire, which quickly threw it into confusion. Then it was that Seydlitz's squadrons emerged from their concealment, and taking advantage of the confusion which the artillery had occasioned, thundered down on the Allied horse, and rode through and through them. Later on again, when the cavalry had been drawn off to reform and gain breathing time, the great battery on the Janusberg plied the Allied infantry with a destructive fire, and prevented their forming up to their left to withstand the advance of the Prussian infantry under Prince Henry, and crushed by this fire the Allied troops broke and melted away.

A Würtemberg Dragoon,[1] writing of this phase of the action, has said, "The artillery tore down whole ranks of us; the Prussian musketry did terrible execution."

It is unnecessary to enter here more closely into the details of this battle; it is enough to say that by the genius of Frederick 50,000 to 60,000 men were signally defeated by 4000 cavalry, seven battalions, and the action of 18 guns pushed early into the fight, and handled with decision, skill, and energy.

Many lessons have been drawn from this justly celebrated fight, but it is doubtful whether the important share which artillery played in it has not often been lost sight of. Yet in it we have a magnificent example of the three arms all working together as they should, and artillery almost for the first time takes its place as an arm capable of producing an independent effect, and advances to try conclusions with the others boldly, and with confidence in what it can accomplish. It first disorganised with fire the Allied cavalry attempting to deploy, and facilitated Seydlitz's brilliant stroke. It then turned its attention on the Allied guns, and crushed them ere they could act against the Prussian cavalry and infantry. Finally, it genially cooperated with its own infantry in their advance and shattered the attempt at resistance which the numerous hostile infantry endeavoured to make, while eventually it again prepared the way for Seydlitz's second charge, and paved its road to victory.

Decker thus eulogises the performances of this battery. "We may say with all assurance that the success of the day belonged to the artillery. If, as at Kolin, it had remained inactive, the enemy's infantry could have formed and advanced; its defeat would not have been so complete, and the success of the (Prussian) cavalry would have been

[1] Life of Frederick the Great, by Major-General C. B. Brackenbury, R.A.

less brilliant." St. Germain, writing of it afterwards, declares :—"The first common salvo decided our rout and our shame." Surely Rossbach may be quoted as an example of a brilliant artillery achievement, even though the arm was then first feeling its strength, and its efforts were but the struggles of a vigorous child chafing at its swaddling clothes? The much lauded deeds of Seydlitz's cavalry are, however, chiefly associated with this victory, and admiration for their splendid discipline, the perfection of their training and the genius of their General has blended men to performances which went far to render their success possible, and they have been allowed to ride away with all the credit.

At Leuthen, where Frederick's system of tactics receive their best illustration, the artillery, if they did not accomplish any such brilliant feat of arms as deserves commemoration in these pages, played a part in strict accordance with the principles which should govern their action, and their weight was thrown into the scale in masses at the decisive points in a manner at which the most exacting tactician of to-day could scarcely cavil.

At Zorndorf also, in the following year, a great mass of 60 guns brought a concentrated and most destructive fire to bear on the faces of the great square in which the Russians were drawn up at the commencement of the battle, and 57 guns likewise prepared the attack later in the day on the Russian left.

If, however, we pass on to the battle of Kunersdorf we shall find the resisting power or latent inertia of guns especially well illustrated, just as at Rossbach their offensive force was displayed. And here it is not on Frederick's side that we shall look for artillery successes. No genius directed the tactics of the artillery on that day, no brilliant manœuvre, no stroke of luck assisted them. But a sort of lethal force and impassiveness, such as has ever distinguished Russian infantry, characterised their gunners too, and with stubborn, remorseless, weight of blow they stood their ground, and shivered every attempt of the other arms to close with them. Moreover, while the capacity of the arm in self-defence, when judiciously placed, shines brightly through the story of the close of the fight, we are reminded at the commencement by the fate of a portion of this very artillery force which was eventually so to distinguish itself that the lie of the ground must be studied if guns are to do all they may. A double lesson, therefore, is conveyed, and while at one period of the fight we are shown the strength of the arm, at another we are taught how greatly its power depends on its position.

On the morning of the 12th of August, 1759, Frederick marched to attack the Russians and Austrians who were drawn up on the hills round Kunersdorf in a strongly intrenched position. The Prussian army rendezvoused at Bischofsee, and the main body was to march in two lines round the enemy's right through a thickly wooded country, while a portion under Finck made a demonstration through Trettin to deceive him as to the true point of attack. The Russian right on the Mühlenberg was to be cannonaded from the north by Finck, and from the east by the King, and then the whole force of the

Prussian army was to make a combined effort and sweep them from their positions. The path of the troops which had to make their way through the woods with the King was a difficult one, and it was not until after 11 o'clock, when they had been eight hours on the march, that they were in the places assigned to them.

BATTLE OF KUNERSDORF; 12th August, 1759.

aa Russian Army.
b Austrians under Laudon.
c Finck's Attack.
d Prussian Main Army.
e Attack of Prussian Grenadiers on the Mühlenberg.

As soon as Finck's guns were heard, Frederick opened fire from three batteries on the Little Spitzberg and to the west of it. Meanwhile Finck's powerful force of artillery, amounting to 94 guns and howitzers, pounded the Russians from the other side. The hill on which they were placed had steeply scarped sides, and fire from its top could not therefore search the hollows immediately below. A hill may be too steep for safety, if fire effect be interfered with, as the Russians, and others after them found to their cost. After half-an-hour's cannonade Frederick sent forward eight battalions of his grenadiers to the assault, and so successful was their rush that in 10 minutes their opponents were driven pell-mell from the Mühlenberg, leaving 70 guns as trophies in the hands of the victors. The configuration of the ground had masked the fire of their guns, and the nearer the assault had approached the less loss had it experienced.

The Russians, driven from the Mühlenberg, fled across the hollow called the Kuhgrund, and took up a second position on the opposite height overlooking Kunersdorf. The Prussian guns could not be got up in time to harass the enemy's retreat, and he was able to withdraw unmolested to his second position, from which, with a numerous artillery, he poured a galling fire on his opponents. Ere this second

position could be safely assaulted it was necessary to wait for guns to come up. But the roads through the woods were difficult, and Finck's guns stuck fast again and again as they tried to cross the Hünerfliess, almost impassable for the guns of that period. The success first gained ought to be followed up at once, and his beloved Grenadiers were falling fast from fire to which they could make no reply. Chafing at delay, and confident in the powers of his splendid infantry, therefore Frederick disregarded the teachings of experience, and sent his men to the attack without waiting for the help of the sister arm.

The village of Kunersdorf was in flames and impeded the advance of his left, and he had to fall back, therefore, on a frontal attack. For three hours a desperate struggle raged, but at length the Prussians made their way across the valley. At what a price, however, had success been won! The rules of tactics cannot be broken with impunity, and in this case, if the Prussians gained ground, it was on the dead bodies of comrades that they trod. Their splendid discipline and training, however, in the end prevailed, and they slowly forced the enemy back before them. Frederick said that here more than 100 guns fell into his hands, but Decker thinks the number was nearer 80. In any case, splendid success had crowned the King's daring, and the battle was all but won.

There is much virtue, however, in that "but."—

> "'Tis an old tale; Jove strikes the Titans down,
> Not when they set about their mountain-piling,
> But when another rock would crown their work."

Forty Russian cannon stood firm still on the Great Spitzberg. In front of them, not the abrupt valleys which had impeded the full sweep of the fire of the others, but gently sloping ground stretching like a glacis to the front. To their left a little behind them, too, Laudon had rallied the Austrian guns, and a great mass of artillery posted so as to put forth all its strength still stood between Frederick and complete victory. Seydlitz and his other Generals recognised their opponent's strength, and begged their master to be content with success already great. News was brought to him, however, at this moment that the enemy were retreating across the river at Frankfort, and his anger rose as he saw the chances of converting a victory into a decisive rout slipping from his grasp. He could not be content to do well when he might do better. The tiresome, slow guns were not yet come up in anything like adequate force, but in his impatience and pride he flung prudence to the winds, ordered some pieces to fire on the bridge to check the retreat, and then sent his tired battalions to attack again without waiting for their comrades to come up and co-operate. Those of the left wing had not as yet been engaged, and they it was who now were sent to scale the Spitzberg.

But chastisement followed swiftly on the fault, and, as Decker says, the arm whose services in his blindness he thought he could dispense with was the instrument which in his enemy's hands was to bring upon him all the mortifications which fate ordained he was to suffer. As his infantry attempted to climb the slope of the Spitzberg such a storm of case shot struck them that they were hurled headlong to the bottom.

Then, wild with wrath the King called Seydlitz and bade him try the task with his horsemen. But the same withering fire burst again from the slopes above and the compact squadrons broke and fled before it, nor drew bridle till they found security beyond the lakes of Kunersdorf. Again the gallant infantry were called on to advance, again were driven back, and again returned to meet with a like fate. Three times did the King himself lead the assault, three horses were killed under him, and but for a metal box in his pocket he would have been killed. And in front meanwhile a like scene was being enacted. It was here Laudon had rallied his artillery, and a great mass of guns spread destruction round it on all sides. The battalions struggled forward again and again, but shattered themselves to pieces against it in vain. Then the cavalry were once more sent round to the east, but when Eugene of Würtemberg was about to charge he found no men behind him. They had no stomach left to face those batteries again.

The inevitable and final scene was now at hand. Even the bravest veteran at length realised that the struggle was hopeless, and the battalions began to fall back. But swiftly as they fled the missiles of the avenging batteries followed faster, and when Laudon led the Austrian cavalry to the charge, the Prussian army became a miserable mass of fugitives and melted away, leaving 172 guns as trophies in their enemy's hands; while, besides these he recovered the 150 he had himself lost earlier in the day. The Prussian loss amounted to 534 officers and 17,961 men, while the Allies lost 670 officers and 15,506 respectively. Thus did a great mass of artillery succeed in converting what seemed fair to become a grave disaster into a great victory, and guns were able to assert the claim which since then they have more than once made good, that, judiciously placed, they have nothing to fear from the onslaught of even the best soldiers of the other arms.

So far we have shown guns either preparing the way for the attack of the other arms, or displaying their own power of defence. A nobler *rôle* than even these, which from the times when guns could move with any ease has fallen to artillery, remains however to be illustrated, and it is with this one that we would next deal. Great as is the exultation with which artillery is justly fired, when it can move forward in the pride of power to deliver some great blow that will level the opposition before it, and just as is the triumph with which it may look back on a position stoutly held, and the fierce surges of attack breaking uselessly on its iron front, its highest and most legitimate satisfaction is experienced when the spirit of self-sacrifice has animated its efforts, and it has been able to stand between its comrades and destruction. Guns well lost are as proud a boast as captured colours, and the glory gained in the hour of defeat shines sometimes brighter than that which illumines the close of a victorious day. Frederick, crafty warrior as he was, had often to feel the anguish of a lost battle, and like his great successor, Napoleon, sometimes with a headstrong confidence in himself, compromised his safety by risking enterprises which men with less imagination would have recognised as so dangerous as not to be worth attempting. In the battle we have just described he lost all by playing for too high stakes, in the one we are now to deal with he also

yielded to his mad self-will and temper, and failed simply because he insolently ignored in his passion what are now recognized as the most elementary principles of the game of war.

On the 10th of October, 1758, he found the Austrians under Daun in greatly superior numbers in a strong position, the key of which, the Stromberg, which he had intended to have been seized by his advanced guard, sent forward under Retzow for that purpose, he perceived to his disgust was already held by them in strength. In furious anger he placed Retzow in arrest, and in his contempt for Daun he insisted on encamping within a mile of his troops and in a position inferior to theirs. Next morning he made an effort to gain the Stromberg, but the hill having been strongly intrenched was found impregnable. Frederick, not believing that the Austrians would attempt to move, intended to wait till the 14th and then turn their right, but when Daun found himself in a strong position with 90,000 men, while his foe lay in front of him with but 40,000, and with his troops widely separated on a very extended line, he was fired with new and unexpected energy.

A battery of 20 guns strengthened the Prussian right, while 30 were placed on the left where the King himself commanded, half-a-mile only separated the advanced posts of the two armies, and behind the Austrian position lay thick woods.

During the night of the 13th, while Frederick's men were asleep and he was planning his attack, 30,000 of his foes slipped through the woods round his right, while 20,000 men of the Austrian right were similarly enveloping his left, and preparing to assail the great battery of 30 guns on which it rested. Retzow, away at Weissenberg, was to be assailed too, and held off from coming to his master's succour.

BATTLE OF HOCHKIRCH; 14th October, 1758.

aa First position of Austrian Army.
c Austrian Reserve.
dd Prussian Army.
ee Two main Prussian Batteries.
g Prussian advanced guard under Retzow.
h Advance of Austrian Army.

At 4 o'clock on the 14th the Austrians were all in the positions assigned to them, while their watch-fires remained burning brightly and deceived the Prussian sentries. At 5 o'clock the attack on the Prussian right began, and soon the woods were re-echoing with musketry. Gradually Frederick's men awoke to the consciousness that no ordinary affair of outposts was going on, but that a serious effort was being made on their camp. Heavy mist and fog shrouded their view on all sides, and they could neither see where their enemies were nor how strong was their force. The account reads very much like that of Inkerman, although the sequel was very different.

The Austrians outnumbered the whole of that portion of the Prussian army under the King's command. His battalions were surrounded and cut up in detail. The guns fired aimlessly into the mist and darkness, and were captured ere long. Then brave Keith led one battalion up the hill again, and drove the enemy away from their trophies. But his weak force was soon surrounded and overwhelmed, and he himself fell dead, shot through the heart.

Meanwhile Frederick began to realise that old Daun had developed more enterprise than he had given him credit for, and that he himself was fighting for the very existence of his army. He hurried what reinforcements he could spare to his right, but they too were repulsed, and Moritz of Dessau, who led them, fell wounded into the hands of the Austrians. Then the King himself rushed into the fight, but he could not make any headway, his horse was shot under him, and as the mist lifted he saw that his right was hopelessly hemmed in, and that all on that part of the field at any rate was lost. The Prussian front was also now assailed, and it became plain that the only chance of saving any portion of the army was to concentrate what remained unbroken, and retreat as best he could by the Pass of Drehsa along the stream. Two batteries on the heights near Drehsa, and another of ten heavy pieces, directed by the King himself, nearer to the thirty gun battery which, as has been said, had guarded the Prussian left, were hastily got together and placed in position to cover the retreat.

And well did these masses of guns respond to the call made upon them. The Austrian left wing, closing in with triumphant strides, was held in check by the two great batteries in front of it, while the thirty gun battery, like some great rock that alone braves the rising flood, stood almost alone in their way on the Prussian left. Twice it repulsed the attack of the Austrians and gave time for the defeated infantry to rally. But at length, about 9 o'clock, the gathering tide of advance overwhelmed it, unsupported as it was, and it was captured. Yet it had done its work. Its sacrifice had gained safety for the infantry. The guns it is true were lost, but meanwhile the King had formed a fresh line and could hold his foe once more at bay. His extreme left, under Retzow, had also managed to escape under the covering fire of two batteries which skilfully and firmly resisted the pursuit, and now joined the remainder with Frederick. A general retreat was ordered, what guns were left to the Prussians covered the movement with the same gallantry they had already displayed, and the Austrians did not care to try conclusions with them at too close a range. Thus the relics of the force were

extricated, but 8000 killed and wounded and 101 guns lost marked how serious had been the defeat.

Decker, the historian of artillery achievements during the Seven Years' War, dwells with pardonable pride on the deeds his arm performed on this occasion on the Prussian side, and enumerates no less than nine distinct occasions during the action when, but for the cool courage and energy of the gunners, the attacks of the enemy must have been crowned with decisive success. He goes on to say that if the Austrian artillery was not as fortunate in the attack as that of its opponents was in the defence, it did not bear itself less gloriously in the arduous labours imposed on it by a victory dearly bought. We may quote his concluding sentence :—

"*Quiconque a une idée du désordre qui règne dans une attaque de nuit, s'empressera de rendre justice a l'artillerie Prussienne, et de convenir qu' il fallait qu' elle fut bien disciplinée car sans cela ses pertes, en pièces de position surtout, eussent été plus considerables.*" [1]

The last action we shall describe is one which is remarkable, because, although artillery had a predominant influence on the progress of the battle, its greatness was thrust upon it oddly enough by the incapacity rather than the skill of the General under whose direction it found itself. Its latent power was developed only by chance, and the arm accomplished a great feat in spite of the indifference with which it was treated.

The incident must specially interest us, because it is only a more than ordinarily striking illustration of the manner in which artillery was often regarded at the period of the Seven Years' War, and of how it overcame prejudice and asserted its claim to at least an equal share of consideration with the other arms by what it effected by itself, and by the merit of its performances alone.

Up to the middle of the last century it had been regarded as a rather cumbresome appendage to the infantry, it had no independent leader of its own, no one therefore to speak for it, and was obliged to conform slavishly to the movements of the infantry, save when some General with an intelligence in advance of his age, such as Gustavus Adolphus, perceived its powers and handled it accordingly. Frederick blamed his artillery for letting him be surprised at Hochkirch, just because it was safe to make a butt of an arm which had no one to reply for it. Yet it helped him to win Rossbach, and saved him from ruin after he had found fault with it at Hochkirch. He had felt the weight of its blow at Kunersdorf, when he attempted to ignore it, and now it was again to make him respect its strength at Torgau.

On the 2nd of November, 1760, Frederick was at Schilda. His old antagonist, Daun, faced him at Torgan in a very strong position, his left protected by the great pond (Grosser Teich) and the Rohrgraben, his right on the heights near Siptitz, and the reserve behind Grosswig. The fault of this position was that there was not room for his force to manœuvre, and the artillery, of which he had an immense force, were especially cramped for room. Therefore Daun, and because, too, he still cherished old-fashioned notions, left a large reserve of guns in his rear, and for once success was developed by ineptitude.

[1] "Batailles et principaux combats de la guerre de Sept Ans.'

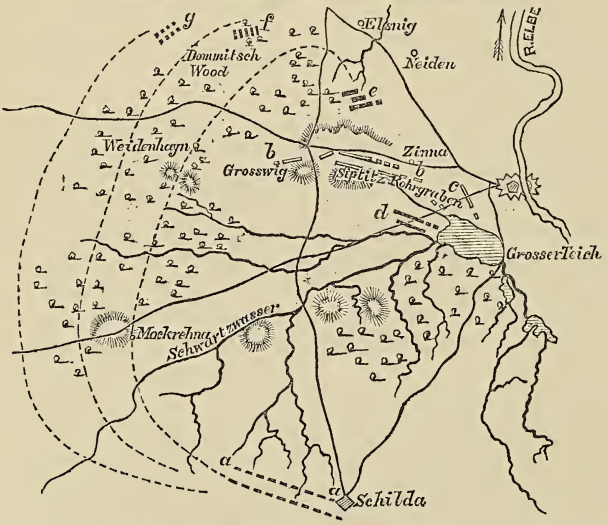
The King realised at once that the position was too strong for any conventional form of assault, and yet it was imperative, for reasons which we need not enter into here, that he should bring his opponent to battle. He had a great contempt for stupid old Daun and his powers of manœuvre, and he thought that the densely packed masses before him, if they attempted to change front, would probably find themselves in such confusion as would allow him to defeat them. Therefore he made a bold resolve.

He determined to attack them both in front and rear, and to detach Ziethen with about half his force to move along the Butter Strasse and assail the Austrians on the west of Siptitz Hill, while he himself moved round their right in the shelter of thick woods and attacked them in rear. Frederick's total strength was about 44,000 men, that of Daun, 65,000.

At 6.30, on the morning of the 3rd of November, the movement of the King's army began. Ziethen moved along the Butter Strasse, while Frederick divided his half of the army into three columns and directed them as follows :—

The right column nearest Daun was commanded by himself and was chiefly composed of infantry. It was to march by Mockrehna, Weidenhayn, and Neiden. The second, under Hülsen, was to move round on his left and come in at Elsnig. The third, which contained nearly all the cavalry and only a small force of infantry, was to sweep round further out still, and eventually join Hülsen at Elsnig.

BATTLE OF TORGAU; 3rd November, 1760.



aa Prussian camp at Schilda.
bb Austrian Army.
c Austrian rear guard.
d Prussian detachment under Ziethen.
e Frederick beginning the attack.
f Hülsen's infantry.
g Holstein's cavalry.

The army started on its enterprise in heavy rain, and the path of the

troops who were to make the turning movement lay under dripping trees. The woods were occupied by Austrian light troops, and soon Daun was informed by them of what was taking place. Meanwhile the difficulties of the road increased at every step, and delays occurred where minutes were of importance. Frederick was in fact again staking the safety of his force on the chance of his opponent making a mistake. If his arrangements miscarried, his army might be destroyed in detail, and the success of his plan of attack naturally depended altogether on accuracy of execution, for it was essential that the blows from front and rear should fall on Daun simultaneously. We can here give no more than a very brief outline of the general events of the day, our attention being turned chiefly to the part played in it by artillery, and it is therefore enough to say that the King's arrangements miscarried through various causes, and that Ziethen was tempted from his true point, deployed his troops, and became involved unnecessarily soon with the Austrians away to his right towards Torgau.

The columns with the King were much delayed by the rain and the softness of the roads. The guns sank deep into the muddy ground, and Frederick, anxious to keep his appointment with Ziethen, pushed on with the infantry alone. More difficulties and more delays further held him back, and finally goaded on by the roar of Ziethen's guns, and the fear that his lieutenant might be beaten alone, Frederick determined to strike in. He had with him seven battalions of Grenadiers, a regiment of Hussars, and Ramin's brigade of five infantry battalions. Also 20 guns.

But to his astonishment the Austrian front opposed to him bristled with an unusually powerful line of guns, and seeing the hopelessness of engaging in an artillery duel under the circumstances, the King sent the Grenadiers forward to the attack at once. For, when Daun had realised the intentions of his opponent, he attempted to change front, and made such dispositions as would move his best regiments to face the King, but the space being restricted, and the time limited, he felt unable to manœuvre his reserve artillery simultaneously with the remainder of his troops. Therefore, it happened that left as it was at first, in rear, it eventually found itself in front of the new position he had taken up, along the whole of which it was now stretched.[1]

When the Prussians advanced to attack the left of the position from the wood through which they were moving, these guns received them with a tremendous fire of grape, and dealt the most frightful destruction through their ranks. One brigade was almost completely mowed down, and all its officers and men killed and wounded by this "hellish fire," as the King spoke of it. The Grenadiers ceased to exist as a body. The Austrian cavalry rushed down upon them to complete the rout, and of the seven battalions that had begun the advance, there were not left enough survivors to form one.

In the moment of need the Prussian guns had left their cover to try and support their comrades, but the odds against them were so tremendous that they were instantly destroyed too.

The late General Brackenbury in his "Life of Frederick," quotes

[1] Decker says that the great battery thus accidentally formed numbered from 80 to 100 guns.

the words of Templehof with reference to this disaster, as given by Decker:—"The batteries which the artillery sent to the left of the wood were annihilated in an instant. They had not even time to load their guns. Already the officers, the gunners, and the drivers were either killed or wounded by the artillery fire of the enemy." According to Decker, too, the King turned to General Sybourg and said, "Did you ever in your life witness such a cannonade? I, for my part, never have." General Brackenbury goes on himself to say, "such was the effect of Daun's accidentally leaving a mass of artillery in front of his army. Yet, in the face of such facts as these, there are still men who doubt the physical effects of Field Artillery fire."

As successive Prussian reinforcements arrived on the scene they struggled on against these guns gallantly, but with little effect, until, as the shades of night closed in and friend and foe became intermingled, their fire was able to effect less, and the Austrian formation was more or less broken. The King was wearied and wounded, and so also was Daun. Both left the field, and what the outcome of the fight might be on the morrow no man could say. Ziethen, however, in the darkness blundered on to the key of the position from the other side, and the Prussians, under old Hülsen, who were preparing to bivouac on the field, roused themselves to a final effort, and succeeded in forcing the Austrians gradually back to Torgau and across the river. The victory after all was for Prussia, and the King's last battle ended in success.

The Seven Years' War dragged out its length for two years more, but no brilliant actions took place on either side, and the actors were becoming tired and weary of their parts. What is noticeable as regards tactics is the progress made by artillery during it, and how at its close the arm came to be appreciated and understood as it never had been before. At the commencement of the war the number of pieces was between two-and-a-half and three per 1000 men, but at its close the proportion had increased to four, five, six, and even seven guns. A numerous artillery saves the troops of the other arms and gives them confidence, and as hostilities become protracted a tendency to increase the number of guns is ever noticeable. We cannot conclude the story of his battles more fitly than by quoting one of the great Frederick's axioms: —"The fewer guns brought into action the more human blood has to be spilt."

In all that has hitherto been said no word appears with reference to our own artillery of the period, and in truth it does not seem that it had accomplished up to this time any such striking feat as is worthy to be commemorated amongst the great deeds of other nations. At the same time we may feel a just pride in the reputation which our batteries, even at this early time, had earned for themsleves on the continent, and their conduct appears to have been second to none of those who took part in the great struggle in the middle of the last century.

If they failed to leave any decided mark in the actions where they fought, it may, we think, be fairly attributed to their lack of opportunity and the smallness of the force they brought into the field, rather than to any deficiencies on their part as regards training or courage.

It may be mentioned, however, that the records of the time do furnish us with such evidence of their distinguished conduct on two occasions that it will be a pardonable partiality to draw attention to them here, even if their performances were scarcely on the scale of those of which mention has hitherto been made.

At Minden, fought the 1st of August, 1759, where the misconduct of our cavalry under Sackville was only atoned for by the splendid courage of our infantry, who bore the brunt of the day's fighting, and carried off the largest share of its honours, the English artillery likewise provoked the admiration of their allies.

At 10 o'clock at night, when the whole of the French line was in full retreat on the bridges, Decker says that a part of the allied artillery effected a manœuvre, "which could not have been more dexterously performed even in the present day."[1] "Two light English batteries which formed part of the right wing persistently followed up the enemy along the shores of the marsh of Hahlen, harassed his retreat, and finally took up a position opposite the bridges." Being joined later on by two of the batteries of their allies, the fire of the 28 pieces thus collected prevented the French from establishing themselves in their former camp, and forced them to continue their retreat till they reached the heights of Dutzen.

In his general comments on the artillery of the various nations of Europe which took part in the Seven Years' War, the same historian pays our arm an even higher compliment in the following words:— "The English artillery was distinguished by its mobility, its elegance, and, above all, by the excellence of its *matériel*. Its administration was never degraded by a sordid economy. In the combat of Marbourg (31st July, 1760), although the English guns were not horsed, they followed the cavalry of Lord Granby at the trot, and were always ready when required in action. When the French fighting in retreat sought to take up a position on the right bank of the Diemel, it was this artillery which prevented their doing so."

Templehof also says:—"The English artillery could not have been better served, it followed the enemy with such energy, and plied him with so hot a fire, that it became impossible for him to rally."

Thus we leave the era of Frederick, but even as the old man is sinking into the grave, dark storm clouds are rising towards the west. They bear the French Revolution, and behind them the eagles of Napoleon are circling in the air.

NOTE.—The maps illustrating Frederick's battles have been reproduced from the life of him written by the late Major-General Charles Brackenbury, R.A.

[1] 1836.

(To be Continued).

NOTES OF LECTURES

ON

ARTILLERY IN COAST DEFENCE.

BY

MAJOR A. C. HANSARD, R.A.

(Instructor of Gunnery).

PART III.

Fire Control.

Under the head of "Fire Tactics" we considered the questions what object to fire at, and what projectiles to use. We now have to consider the means by which we can ensure that those projectiles shall hit the object.

A foreign writer has said that the object of a good system of "Fire Control" (or control of the trajectory), should be to enable the Commander to hold, as it were, the mean trajectory of his guns in his hand, and direct a stream of projectiles on to any spot he may wish; with the same facility with which a gardener, holding a hose, can direct a stream of water-drops on to first one plant and then another.

There are three methods in use, by which this object is attained more or less completely; the method used depending on the availability of instruments to find the range, or position of the object; or the absence of any such aids.

We will take the last case first, namely, that in which we have no instrumental means of finding the range. The best way to make the method clear is, perhaps, to take an example. We will therefore suppose that an object is approaching us, and is now at a range estimated to be 2000 yards. We first of all fire a shot, at an elevation short of 2000 yards, to make sure that the distance of the object has not been over-estimated; for this first shot an elevation should be selected, so much shorter than that at which the object is believed to be, as will allow plenty of time to load and lay the remainder of the guns. We may suppose that the object is advancing at a rate of about four miles an hour; at this rate it will take about a minute and-a-half to cover 200 yards; we, therefore, fix on 1800 yards as the elevation at which to fire our first shot. The burst of the shell (or with heavy guns, the splash of the projectile) will show us whether this shot fell beyond the object, or between us and the object; and if the latter, we can judge

whether it was well short or close up. We cannot estimate the amount by which it was short, or at least any such estimate is likely to be very misleading, but we can almost always tell that it was certainly a good deal short or not very much short. If not short or close up, we should have to take off another 200 yards elevation and try again; but if well short, the greater part of the guns, which have been told off as "salvo guns," are loaded and laid at an elevation somewhat shorter than that of the first shot, in this case at 1750 yards, the fuze (for time shrapnel) being bored accordingly. The whole of the guns are kept laid on the object, the "ranging guns" with an elevation of 1800 yards, and the "salvo guns" with 1750 yards; and at intervals a shot is fired from one of the ranging guns. As long as these shots are observed to fall short, we know that the object has not yet arrived at the 1800 yards range; but as soon as one is observed to hit, or to fall over, we know that it has arrived at or passed that range, and, making a short pause, a salvo is fired from the salvo guns; the ranging guns are again loaded and laid at 1600 yards elevation, and the salvo guns at 1550 yards, and the process repeated. If the object had been retiring instead of advancing, the process would have been reversed; the first shot would then have been fired at a range greater than the estimated range, and if that fell well over, the salvo guns would be laid with an elevation 50 yards more than that of the ranging guns. Now what was done in the above example was, that a range of 1750 yards was predicted as the range at which to fire the salvo guns; and by using a portion of the guns (in practice usually two guns are told off for this purpose) as a range-finder, we were able to tell when the object had advanced to within 50 yards of the predicted range. The difference of 50 yards is to allow for time to observe the result of the last ranging shot, to communicate to the salvo guns the order to fire, and for the time of flight of the projectiles. If the speed of the object is increased, a larger difference must be made between the elevations of the ranging and salvo guns; and also a larger difference between two successive predicted ranges.

Where several groups are being fought together under this system, the leeward group would usually be told off as the ranging group, the remaining groups as salvo groups, and the fire control would be in the hands of a Sub-Commander; where one group is acting alone the Group Officer would have to control the fire, and would tell off his two leeward guns as range-finding guns.

This system would usually be employed with guns of the movable armament, or those of the secondary armament not supplied with the depression range-finders, but even guns of the primary armament must be fought by this method, if their position or range-finding instruments are for any reason unavailable.

The ammunition to be used depends on considerations already treated of under "Fire Tactics;" if boats are to be attacked, time shrapnel will be used with the salvo guns, and percussion shrapnel or common from the ranging guns, according to the size of the guns; from small guns common is the best to use on account of its larger bursting charge, but with medium and heavy guns shrapnel would be preferable

on account of the bursting charge being large enough to give a visible burst and the advantage of using the same projectile throughout; or segment from R.B.L. With heavy guns when time shrapnel is not to be used from the salvo guns, both they and the ranging guns would use the same projectiles.

When ranging with percussion shell, the object should be to get the shell to burst to windward of the target, so that the drifting smoke may give a clear indication of the result of the shot; sufficient deflection must, therefore, be given to carry the shot to windward, unless the target has a broad front, when it would be sufficient to lay on the windward flank, without more deflection than is necessary to counteract the wind and bring the shot on to the point aimed at. The salvo guns will, of course, only have this latter deflection if the object is advancing or retiring direct. If the object is making a diagonal course, with regard to the line of fire, deflection will also be necessary to compensate for the transverse movement during the time of flight; which may be taken as five seconds with R.M.L. guns at medium ranges. A rough rule, to find the number of minutes deflection necessary, when no instrument is available by which the angle moved through by the target in a given time can be measured, is to multiply the (supposed) rate of the object, in miles per hour, by five. In the case of a diagonal course, the distance between successive predicted ranges may be decreased, as also the difference between the elevations of the ranging and salvo guns. An object in motion cannot remain at a constant range unless it moves on the arc of a circle, in such an unlikely case the range could be found as for a standing target.

The system of fire control without a range-finder when the object is stationary is briefly as follows:—In this case all the guns of a group are used to find the range. The first shot, from the leeward gun, is fired at the estimated range of the object, the second with so much added to or subtracted from it as will ensure its falling on the opposite side of the object; if successful in this, the object is now included between two known ranges; this is called obtaining the "long bracket;" the next shot is fired at the mean of this bracket, and the next at the mean of the last elevation that gave a + and the last that gave a −; this process is repeated until the object has been included between two elevations (ranges) which only differ by 50 yards; called the "short bracket;" a "verifying series," of usually four shots, is then fired at the mean elevation of the short bracket; if the result is that half of the verifying shots go over and half under, the mean trajectory passes approximately through the water-line of the object; if that object is a low one, such as a boat, we should accept this as the correct range; if the object is a high one, such as the side of a ship, we must raise the mean trajectory by adding on 25 yards elevation; anything over five feet should be looked upon as a high target. If three-fourths of the verifying series are overs, the mean trajectory passes above the water-line, and we should keep to that range with a high target, but reduce by 25 yards for a low one; if three-fourths are unders, the mean trajectory is short of the object, and the range must be increased. If the first three shots at a low target, or the first two at a high one, are under, the

proportion is already wrong, and the verifying series should be continued at the increased range; if the first three are over, at a low target, the proportion is already wrong, and the series should be continued at the reduced range. Deflection, in addition to that required to counteract wind, must be given for the ranging shots, to carry the shot to the windward of the object and facilitate observation, unless the object has considerable breadth; this additional deflection should be taken off when the verifying series is arrived at.

When time shrapnel is to be employed, the fuzes will have to be verified after the range is found; the mean height of burst of two fuzes, bored to the same length, being taken as the datum from which to correct the length. The rule for height of burst is that the apparent height in feet above the point aimed at must not exceed the number of hundreds of yards in the range; this is for R.M.L. or R.B.L. guns; for B.L. guns the number of feet must not exceed two-thirds of the number of hundreds of yards.

In all ranging it is most important that all the guns should invariably be laid on the same spot; in coast gunnery this spot is defined to be the water-line at the stem of the ship; or when the ship is in such a course that the stem is not visible, on the water-line at the stern; if it is wished to shift the trajectory to any other part of the object, this must be done by corrections on the scales and not by laying on a different part of the object. When time shrapnel is used at the decks of ships at anchor, the elevation must be corrected to shift the trajectory on to the deck, and the height of burst judged from the level of the deck.

The following notes as to ranging at a standing object may be found useful. First, it is better to get the first shot short rather than over, as giving a more easily observed result; especially on service, where the object would be, probably, obscured at intervals by its own smoke; but as our endeavour should always be to hit the enemy if possible, the first shot must not be fired at a range which is *known* to be less than that of the object.

Secondly, do not be afraid of a bold alteration in elevation for the second shot; 10 per cent. of the range would be the usual correction, but if the range is quite unknown and a long one, 20 per cent. would not be too much; "creeping" up to the target by small alterations is very slow, and wasteful of ammunition; and, further, it is much more likely to have a disturbing effect on the accuracy of the enemy's fire, if he finds shots falling on both sides of him.

Thirdly, no notice should be taken of the result of a round which was unsteady in flight, or the result of which was not properly observed, or appeared doubtful; always repeat a shot at the same elevation in such cases.

Fourthly, if a hit is obtained before the verifying series is reached, at once commence such a series at the elevation which gave the hit.

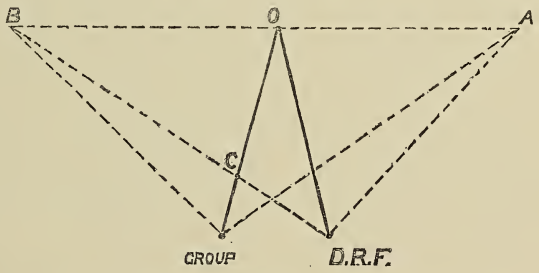
Fifthly, having obtained the correct trajectory with percussion shell, do not alter the elevation when firing time shrapnel; should anything seem to indicate that a change of elevation is required, return to percussion shell and verify afresh. An exception to this rule is when, in

verifying the length of fuze, two or more shells are blind or burst on graze, and all on the same side of the object; these shots may then be considered as if they formed part of the verifying series, and the elevation altered accordingly.

The possibility of obtaining good effect with this system of fire control depends on correct observation of the result of each round, as, indeed, is the case with any system; the most difficult case occurs when the object is stationary and the smoke drifts straight from the enemy towards the guns, or *vice versâ*; laying would then have to be done either by auxiliary marks, or by using clinometer for elevation and marking the racer for direction (if the guns are not fitted with index plates and graduated arcs); and the observation could be assisted, where practicable, by flanking parties, or the ranging may be conducted by salvos instead of by single shots.

The second system of fire control is that used when an instrument is available which can give the ranges continuously of a moving object on the water; such an instrument is the depression range-finder.

This instrument works with a vertical base and, therefore, requires to be at a certain height above the water; it would usually be placed on a flank of the battery, sufficiently far away for the levelling not to be affected by the shock of discharge. Where the site is suitable it is placed behind and above the guns. When flank positions only are available, two stations should be provided, one on each flank, and that one occupied which is to windward, and is, therefore, not interfered with by smoke. In any case the instrument will be at some distance from the guns, and consequently the range as given by the instrument will not be the true range from the guns in all cases. The distance from the centre of a group of guns to the range-finder is called the "displacement" of that group; the difference between the range from the group to an object, and the range from the depression range-finder to the same object, is called the "group difference." This difference is a variable quantity; at *O* on diagram the range is



the same from the group and from the range-finder, and the group difference would be zero; as the object moves from *O* to *A*, the difference is constantly increasing and is a + quantity; as it moves from *O* to *B* it is also constantly increasing, and is a − quantity. Thus the differences vary with the different angles of training of the guns. The difference also varies with the range. When the object moves towards the group from *O* to *C*, the training has, of course, not altered;

but the difference, which at *O* was zero, has become a large minus quantity. For this reason, in order that the tables may remain correct approximately for all ranges, the depression range-finder must not be placed more than about 200 yards to a flank of the groups. These differences are either calculated (which gives the best results), or obtained by construction (in the manner shown in regulations for Garrison Artillery practice) ; and tabulated ; the calculation being made for a medium range of, usually, 2000 yards.

Group difference tables are only made out in multiples of 25 yards ; as are all other tables of range corrections ; the length of the probable rectangle being such that it is not worth while considering any less quantity. The tables show the corrections which have to be made between certain angles of training. There must be in each group a group difference table for each station of the depression range-finder.

The method of using the table is as follows :—The Group Officer, who in this system chooses the actual moment to fire his guns (subject to the orders he may have received from the Fire Commander as to rate and order of firing), watches the dial by which the ranges are passed down to him ; and, taking into account the rate at which the range is altering, and the time that it takes to lay the guns, makes up his mind to commence firing when the dial shows a certain range. He then looks at the training of a gun, first ascertaining that it is nearly on the object, notes the reading on the arc, and referring to his difference table finds against that reading a certain correction ; he makes this correction to the range he made up his mind to fire at, and gives the order to lay with this corrected range ; he then watches the dial again, and when it shows the range at which he decided to fire, he gives the order, "Commence firing." An example, perhaps, makes this process clearer.

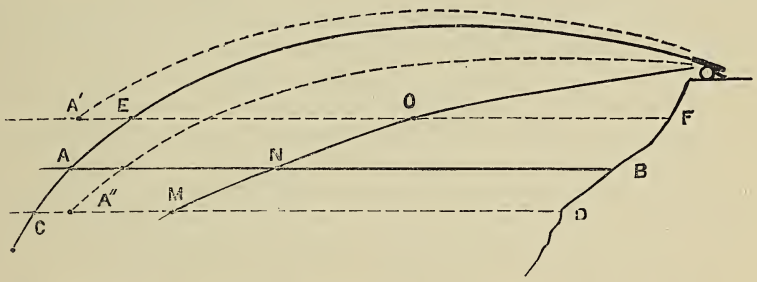
During the loading the Group Officer has ascertained that the range, as shown on the dial, is decreasing by 100 yards every 15 seconds ; when the guns are run up the range dial reads 2500 yards ; he knows that it will take 30 seconds to lay the guns, and therefore decides to fire when the dial reads 2300. As soon as one of the guns is nearly on the object (for direction) he notes that the training reads 330°, referring to his table he finds that between the trainings 315° and 340°, a correction of + 75 is necessary (this means, of course, that in that position the object is approximately 75 yards farther from the group than from the depression range-finder) ; he then gives the order, "2375 yards, lay," and as soon as the dial shows 2300 he gives the order, "Commence firing." In practice it will be found to save trouble if the difference corrections are chalked on the floor against the portion of the arc to which they refer, as the Group Officer is then saved the necessity of referring to the table.

By this means the range from the depression range-finding station to the object is converted, at each group, into the range from that group by the Group Officers.

There are, however, several other corrections which have to be made by the Fire Commander ; for the elevation which must be given to a gun in order to hit an object (which is called the relative range),

is a very different thing from the actual range, or distance from the gun to that object.

The first point to be considered by the Fire Commander is whether his guns are laid by tangent sights for elevation, in the drill-book called case I.; or by index plates, or some other means of giving quadrant elevation, in the drill-book case II. If the latter is used he will have to make a correction to the range due to the state of the tide. The reason for this is shown by the diagram.



The quadrant elevation is calculated for mean tide level, or rather for seven feet above that level (seven feet being about half the height of side of a battleship). Now, if the gun is elevated to a certain range on the index plate, successive shots similarly laid will follow the same trajectory (*E A C* in diagram) cutting the mean tide level *A B* in *A*; if the tide rises to the level *E F*, the trajectory cuts it at *E*; and in order to reach an object at the same distance from the gun as before, as *A'*, more elevation must be given. If the tide falls to *C D*, the trajectory cuts the water-line at a greater distance from the gun, and elevation must be taken off. The error due to tide also varies with the range; at long ranges, where the trajectory is very curved, the errors are small; but at short ranges, where the trajectory is flat, as at *M N O*, the errors are large. Also the errors will not be the same when using R.M.L. guns with low velocities and consequently curved trajectories, as with B.L. guns having high velocities and, therefore, flat trajectories, especially at short ranges. In practice it is found sufficient if a table is made showing the correction necessary at each 1000 yards in range, and for each quarter-tide, the corrections being given in multiples of 25 yards. This correction is not necessary when laying the guns for elevation by tangent scale, as the elevation is then given with reference to the line of sight and not from a horizontal plane.

The next error to be considered is that due to the fact that different brands of powder do not give a constant muzzle velocity to the projectile; and that atmospheric influences, such as increase or decrease of density, due to the presence of more or less moisture, increase or decrease of temperature, barometric pressure, or of wind blowing up or down the range, give variations in the amount of resistance to the passage of the projectile through the air. The effect of these different influences is known as the "powder error," or the "error

of the day." This error is beyond calculation, and can only be ascertained by observation of the results of the first shots; or, if time permits, a few trial shots may be fired at a known range. It should be pointed out, however, that the greater part of this error is due to a deficiency in muzzle velocity, arising from the age or difference of brand of the powder; and that, therefore, the error will not be constant at all ranges. The table at page 310 "Text-book of Gunnery," illustrates this well. It is there shown that with a 12-inch B.L. gun (muzzle velocity 1900) a loss in muzzle velocity of 50 f.s. would result in a loss in range of 50 yards at 1000 yards, and of 175 yards at 4000 yards. Hence a trial shot from this gun, fired at a known range of 1000 yards, and falling 50 yards short, would in reality indicate that a correction of 175 yards was required at 4000 yards. Again, the same table shows that half a gale of wind blowing up the range (towards the gun) would cause an error of one and-a-half yards (practically imperceptible) at 1000 yards, but at 4000 yards the error would be 32 yards. Thus it is evident that reliable information, as to the error of the day, can only be obtained by trial shots fired at a known range, if this range is somewhere about the same as that at which we are about to engage the enemy. It would usually be safe to give a + correction for the first shot, as powder rarely "shoots up to the tangent scale."

When firing at a ship, a further correction must be made to carry the trajectory on to that part of the ship we wish to hit. This is necessary because, as mentioned before, guns are laid on the stem at the water-line (or stern at the water-line when the stem is not visible), and ranges are taken to the same points. If, therefore, no correction is made for length, a correctly laid salvo will all hit about the stem or stern, and some of the shots will certainly fall short and do no damage. We may wish to hit a definite point, as for instance, the forward bulkhead in a central citadel ship end-on at a short range, and in that case would find, in the list of ships, the distance of this point from the point aimed at; but if the length of range precluded any idea of attacking a particular point, we should add on about half the length of the ship, say 50 yards for battleships, so as to bring the trajectory on to the centre; if the ship makes a diagonal course with the line of fire, a less correction will be required. This correction will generally be an addition to the elevation, as we are generally laying at the nearest part of the ship, and trying to hit a point further off.[1] When the ship is broadside-on, or nearly so, no correction to range is ordinarily necessary if using quadrant elevation; but with tangent elevation usually a sufficient addition must be made to raise the point of impact a few feet, viz.: from the water-line which is the point aimed at, to half-way up the side. An exception would be in the attack of a water-line belt at close ranges, where with quadrant elevation some elevation may have to be taken off.

So far the corrections that have been mentioned are equally applic-

[1] When the ship is retiring from the battery in a course which makes an angle of about 45°, or less, with the line of fire, her bows will be visible from the guns, and if that point is laid on, some elevation must be taken off in order that the centre of the vessel may be struck.

able to either a standing or moving object. When the object is in motion, there is yet another correction to be made; this is due to the travel of the object, during the time which elapses between the moment when the drum-reader calls out the range, and the fall of the shot on the water. This time is made up of: first, the time lost in passing the range from the instrument to the group dial; second, the time lost between the Group Officer's command to "commence firing" and the firing of the gun; and, lastly, of the time of flight. The first two times, which are included in the term "time of firing," will vary according to the facility with which the range can be passed to the groups, and also according as the guns are laid by tangent or quadrant elevation; but for a given method of laying in any work, they can be made, by good drill and practice, very nearly constant; and having once been ascertained, this "time of firing" must be always adhered to. The time of flight, of course, varies according to the range.

The actual distance travelled by the object during the time in question is not important, what we want to know is, by how much the range is increased or diminished during that time.

This can be ascertained by watching the dial, and taking the number of seconds which elapse while the range changes by 50 yards. Suppose, for instance, that it is observed that the range is altering 50 yards every eight seconds, and that the time of firing is three seconds, and the time of flight for the range is five seconds; then a correction has to be made for the alteration of the range during eight seconds, and as this alters 50 yards in that time, 50 yards will be the correction to be made. If the range altered 50 yards in four seconds, a correction of 100 yards would have to be made; and if it altered 50 yards in sixteen seconds, a correction of 25 yards would have to be made. The correction must be added if the range is increasing; subtracted if decreasing. Tables are made out to show the corrections at various ranges. Separate tables are required for case I. and for case II.; the "time of firing" being different in each case.

The explanation of these various corrections to the range takes some time, and it may, therefore, appear as if much calculation was involved; but, as a matter of fact, with a little practice the application of them is easy.

Before an action commences the Fire Commander will know by what means his guns have to be laid, and consequently whether the correction for tide will be necessary or no. If so, he will have also ascertained the state of the tide; then, as soon as his object is indicated to him by the Section Commander, and its range approximately obtained, he can by reference to the table see the necessary correction. He will make a correction for powder, either as the result of observation of previous rounds or for the first shot by an estimate. He will also make a correction for the length of the vessel, which need be only approximate. Lastly, he will observe the rate at which the dial is changing, and make a correction for "time of firing." It is convenient to have a note-book ruled in columns as follows:—

	+	−	+	−	+	−
Powder... ...	50					
Tide		25				
Length... ...	50					
Time of firing		25				
Nett Total	+ 50					

The nett result of the several corrections he will give to the dial number, who will show the range, as read by drum-reader, corrected by this amount.

For instance, suppose the guns (9-inch R.M.L.) to be laid by quadrant elevation; the tide to be low; range 3000 yards; object, a battleship, approaching nearly end-on; and powder has been shooting 50 yards short at this range.

Then, the Fire Commander sees by his table that for low tide at 3000 yards — 25 is the correction required, and enters it in the — column; for powder he enters 50 in the + column, and the same amount for length of ship; he now ascertains that the range is decreasing 50 yards in 20 seconds; looking to the "time of firing" table for case II., he sees that the correction is 25 yards, and, as the range is decreasing, this must be entered in the — column. The nett result of these corrections is + 50, which he, therefore, gives to the dial number, who, until a fresh correction is given him, will always show on his dial 50 yards more range than is read out by the drum-reader.

The Fire Commander will also have to correct for deflection; for which three things have to be considered; first, if the wind is across the range, sufficient deflection must be given to counteract its effect; secondly, a correction must be made (except when the ship is end on to the guns) to carry the trajectory from the point aimed at (viz., the stem) to the point we wish to hit; these two corrections being necessary for stationary as well as moving objects. Lastly, correction must be made for the travel of the object during the time of flight. The actual distance travelled in this time is not of moment, the essential point to be ascertained is the arc traversed by the object. For instance, if a point moves through an arc of one degree in five seconds of time, and the time of flight is also five seconds, it is clear that we must lay the gun one degree ahead of that point in order to hit it; if the time of flight were 10 seconds, we should have to lay two degrees ahead; and if two-and-a-half seconds, half a degree ahead, and so on. When the guns are laid by quadrant elevation the time of flight is all that need be considered, as the gun-layer standing on the sighting-step keeps his gun laid for direction until the moment of firing; when tangent elevation is used a small time of firing, to allow for the layer to get down from the slide, must be added to the times of flight. Thus there must be two tables, one for case I. and one for case II., as with the range correction. The time taken by the object to pass over

one degree, can be ascertained by watching the graduated arc of the depression range-finder.

These corrections can also be conveniently noted on a ruled form as :—

	L.	R.	L.	R.
Wind	10			
Length	60			
Time of flight		45		
Nett total... ...	25 L			

To take an instance, suppose a battleship broadside-on (300 feet long) passes from L to R over one degree in ten seconds ; range 3000 yards ; wind from left to right requiring 10 minutes to counteract it ; then 10 minutes L are required for wind ; $\frac{150 \times 12}{30} = 60$ minutes L are required if we wish to hit her in the centre ; and from the table 45 minutes R to correct for time of flight ; or a nett result of 25′ Left. As the service dial can only signal in quarter-degrees this would be signalled as half a degree. It may be remarked that a very rough approximation would be sufficient in engaging so large an object as a battle-ship, unless we wished to attempt the destruction of a definite portion of her ; since if she is end-on only wind correction is required ; and if broadside-on, and in motion, the corrections for length and for time of flight will approximately cancel each other.

The corrections, both to range and to deflection, can only be looked upon as approximations ; the only way to get good shooting is to carefully observe the result of each shot, or salvo, and make corrections accordingly. Many circumstances which defy calculation, such as refraction, which causes the object to appear, and the guns to be laid (with tangent elevation) too high, and other atmospheric conditions, affect the shooting ; so that the first shots must always be regarded in the light of trial shots. If the corrections above treated of are properly made, the error cannot, however, be very great ; and in cases where, from the enemy's smoke or other causes, the observation is difficult, unless they are made there can be no chance of hitting the object ; in any case the nearer the first shot falls, the easier it will be to observe and correct the error.

The error in range can be measured by the depression range-finder, the range being taken to the splash of the shot, the difference between this and the range of the ship at the same moment being the correction to be applied for the next round. It has been suggested that this correction may be automatically made by bringing the cross-wire on the splash, and making the horizontal wire cut it by sliding the fulcrum in or out, without altering the range ; then, bringing the wires back on to the object by the drum, a new range will be found—which will be the corrected range. This would give good results at a stationary object, but if the tidal error or a large powder error enter

into the question, it will not give true results; the instrument, set thus with a false height, would give corrections varying directly with the range; while the tidal error varies inversely as the range and the powder error bears a fractional proportion to the range.

The error in direction is best judged by eye, and if the Fire Commander's station is at some distance to a flank of the guns, he must have an observer near them to estimate this error for him, who, of course, must be in communication with him. The angular error in direction can, of course, be measured by the arc of the depression range-finder if the observer is sufficiently well trained. It is much to be wished that a second depression range-finder for the purposes of observation should be mounted in each Fire Commander's station; this would obviate the necessity for taking the other instrument away from its proper function of continuously recording the range.

It facilitates the making of corrections if the tables are mounted on rollers; there should be one roller for Case II., having on it a tide table; a table of corrections to range for a time of firing of (usually) about three seconds; and a deflection table for the times of flight. A roller for Case I. requires no tide table; a table of range corrections for time of firing (usually) about eight seconds; and a deflection table for times of flight plus two to four seconds for gun-layer to get clear of recoil. The tables should be so mounted on the roller that the corrections for a given range come one under the other.

In this system of fire control the Fire Commander is entirely responsible for the correctness of the trajectory; he has, therefore, to make the corrections and observe the results. It should be noted that the corrections will need constant watching; as the range changes, the tidal error may change, also the powder error; if the vessel alters her speed or changes her direction, the rate at which the range increases or decreases will vary, and so will the deflection correction.

The Group Officer's responsibility in this system, as regards fire control, is limited to choosing the proper moment to fire, and to making the proper correction for group difference; he has, of course, the responsibility of seeing that the guns are being correctly loaded and laid and at the right object, but this is part of the duties included under "Fire Discipline." The Gun-Captains are also responsible that the guns are not fired, unless the laying has been properly completed within the prescribed time of firing, even though they receive the order from the Group Officer to commence firing.

The third system of fire control is that used when we have an instrument which can tell us, not only the range to an object, but the position of the object with reference to the guns, that is the range and training necessary. The position-finder is such an instrument, and it automatically records, on dials at the group, the range and training to the object from the group by simply bringing the telescope of the instrument on to the object; thus the necessity for a group difference correction is done away with; but there must be a separate instrument for each group.

In this system the guns are laid, not on the object but on a spot over which it is about to pass, and fired when it comes over that spot.

The process is shortly as follows : The operator at the instrument, who has been informed by the Fire Commander of the ship, and the portion of it, if any, which he wishes to attack, follows up the object until he receives a signal from the group that they are ready to lay. The instrument is provided with a pencil which, as the telescope is moved, traces on a slate the course followed by the object on which the telescope is directed. As soon then as he receives the signal he traces the course of the vessel for, say, a half-minute and then "predicts," by reference to this course, where the object will be at the end of another half-minute; certain corrections have to be made, as for drift (the guns being laid by training arc and not by tangent scale for direction); for travel during time of flight (no time of firing enters into this case, as the guns are fired electrically from the position-finding station, at the moment when the object comes over the predicted position); for powder, length of ship, and tide; but these corrections are made, simply, by the application of scales. The point at which the gun must be laid, in order to hit the ship in the selected part as she comes over the predicted position, having thus been found and marked on the slate, the pencil of the instrument is brought over this spot; a signal is then sent to the group that the training and range, then showing on the dials, are those at which the gun is to be laid. The pencil is then brought over the predicted position, and as the ship crosses the cross-wires of the telescope the operator fires the guns.

The observation of result, and correction of error of the shot is effected very easily by means of a flexible finger attached to the instrument; the cross-wires of the telescope being brought on to the splash, the flexible finger is brought over the point aimed at, thus automatically showing for the next shot the correction required; for if the pencil is brought over the next predicted position of the object the finger will show the point that must be aimed at.

This system gives the most perfect division of labour; the Fire Commander can devote his entire attention to the effect produced by his fire on the enemy; the operator makes all corrections to ensure the trajectory passing through the desired spot; and the Group Officer can devote his entire attention to the superintendence of the fire discipline of his group.

The Group Officer has control of the fire to the extent that his group cannot be fired without his orders, so ensuring that the guns are properly laid; also the prediction can not be made until his order to lay is given; a switch, which controls the firing current for the whole group, and worked by a dial number under the Group Officer's orders being placed in the group.

A firing plug, which makes another controllable break in the firing current, is placed in the circuit for each gun, under charge of the Gun-Captain, who does not insert it until he is satisfied that his gun is correctly laid at the predicted range and training, and no number is in danger from the recoil. Thus if any one gun of the group is not ready, and the Group Officer, in order not to lose the prediction, gives the order to commence firing, that particular gun will not be fired.

As regards the advantages and disadvantages of the three systems.

With the first, there is the serious disadvantage that a proportion of our guns are occupied in firing at a spot on the water, to tell us when the enemy arrives at that spot; a large proportion of the projectiles from these ranging guns can, therefore, have no chance of inflicting damage, and the volume of effective fire is by so much reduced. Also since we can only tell by this method when the object reaches a range some 50 yards distant from the predicted range, a possible error is introduced. The system has one characteristic which may be set to its credit, namely, that no calculation is necessary, that by its means fire can be maintained at a moving object without the aid of any range-finding instrument, and that no trained specialists are required. It has a further disadvantage from the fire discipline point of view, that when the Group Officer is conducting the fire of a single group, he must of necessity give all his attention to observing his fire, and cannot properly superintend the fire discipline of his group.

In the second system, the necessity for corrections involves possible sources of error which, when observation of fire is difficult, may escape detection. Also, the Fire Commander is likely to have his attention so much taken up by them, that he cannot properly devote himself to the observation of effect of his fire on the object, and to the consideration of the proper moment to change his projectiles.

In the first system the officer controlling the fire must be in or near the battery, and cannot well be in direct communication with his next superior; this is, of course, a disadvantage.

In the depression range-finder system the Fire Commander can be at some little distance from the guns, out of their smoke, and out of reach of shells directed at the battery; the possible positions, however, are limited in most cases; and a shift of wind may necessitate a change to a fresh fighting station. With the position-finder, as this instrument does not involve group difference correction, the best possible position can be found for it, irrespective of distance, the only condition necessary being that it should be at a certain height, and be able to cover the whole area covered by the guns it works; and the cells for several position-finders can be placed so as to be well under the control of the Fire Commander. Also several Fire Commander's stations can be placed within easy reach of the Section Commander's position, thus making the tactical control much easier.

Moreover, for guns mounted in casemates, where the accumulation of smoke would soon render laying over sights an impossibility; or for high-angle guns or howitzers mounted in concealed batteries, from which no direct view of the enemy is possible, this system is a necessity. The presence of smoke in front of a casemated work becomes, with this system, a positive advantage, as tending to prevent accurate laying on the part of the enemy, whilst not interfering with our own. The general introduction of smokeless powder will, however, greatly modify these advantages. With the depression range-finding system one instrument can give ranges for several groups, but can only fight one object at a time; with the position-finding system there must be one instrument to each group, thus necessitating a large increase of specially-trained men, and involving the throwing of a group out of

action, should its particular instrument become from any cause unserviceable. Each group could, however, be directed at a different object or part of a vessel if required. With depression range-finding system there should always be a second instrument in reserve.

In the lecture on "Fire Tactics" it was pointed out that it is very desirable that we should have the power of obtaining simultaneous hits, as close together as possible; this is always of importance as regards the salvo from each group, and is also desirable as regards the fire of a work as a whole.

With any system of fire control in which the guns are laid for direction by sights, the possibility of concentrating the fire on a particular spot is obtained. This is not the case with the position-finding system, as the guns are then laid by the arcs, which are oriented alike, the lines of fire are, therefore, parallel. Suppose a ship, breadth 60 feet, is engaging end-on a group of four guns, fought by position-finder, the distance from muzzle to muzzle being 24 feet, the lines of fire of the outermost guns will be 72 feet apart, and their projectiles will, therefore, miss the vessel. This is a serious disadvantage at present to the position-finding system; it can, of course, be mitigated by sub-division of the groups, but this necessitates a large increase of specialists and instruments, multiplication of lines of communication, a larger number of Group Officers, and, most important of all, we then lose the power of firing large salvos simultaneously.

As regards simultaneous hits, the position-finding system ensures the guns of a group being fired absolutely at the same instant; with depression range-finding system we do not get this absolutely as the guns are fired by word of command; there is no reason, however, why the guns should not be fired electrically by the Group Officer, if the proper fittings were provided, so that this defect cannot be looked upon as inherent in the depression range-finding system. As regards the possibility of obtaining simultaneous hits from a number of groups, this is practicable with depression range-finder, the Fire Commander ordering the Group Officers to all lay for a given range; with position-finder it is not practicable, the Fire Commander having no possible means of pointing out a special spot for prediction to all the operators.

An examination of practice reports seems to show that there is not much difference in the effectiveness of fire conducted by the two systems; if any exists it is in favour of the depression range-finder. At practice, however, usually only one or two guns of a group are manned, if the whole were fired, probably the percentage of hits would be much more in favour of the depression range-finder than it is at present.

It may be noted that if absence of smoke permits laying for direction by sights, the position-finder can be used in the same way as the depression range-finder, and being an improved and larger instrument, correcting automatically for displacement, and requiring no calculations on the part of the Fire Commander, should give the highest possible results. The system of control in this case would be the same as with

depression range-finder, the guns being fired by order of Group Officers and Gun-Captains.

NOTE.—It has been proposed to arrange the training arcs so that the lines of fire should converge at 2000 yards; it should be borne in mind that the angle necessary to converge these lines varies not only with the range, but with the angle of training; therefore this plan would only converge the fire for one position of the enemy. A better plan would be that a dial for each gun should show the correct training for that gun. A difficulty arises in laying guns for direction by training arc, when there are no actual pivots, due to the play between the trucks and racers; the line of fire will vary slightly in direction, though the pointer reads the same, according as the last motion in training was trail right or trail left; the last motion should, therefore, be always in the same direction, in the same manner that the last motion of the elevating gear should always be one of depression.

PART IV.

FIRE DISCIPLINE.

The object of fire discipline is to ensure uniformity in the shooting of the guns.

Without good fire discipline no effective fire control is possible, and the best tactical scheme of defence will be rendered useless. The whole value of Artillery in Coast Defence may, therefore, be said to depend on the efficiency of Group Commanders, Group Officers, Gun-Captains, and Gun-Layers, who are responsible for maintaining fire discipline; and this fact cannot be too often or too strongly impressed on those officers and N.-C. officers.

This is especially necessary under modern conditions of fighting guns, since the Fire Commander is usually at some distance from the guns, and errors of shooting, due to bad fire discipline, are less easily detected by him; thus misleading him (or the operator in the position-finding system) as to the result of his fire. He will naturally suppose that an error in the shot was due to his calculations, and will correct accordingly, when, if the cause of the error at the guns is no longer in operation, his next shot will probably have an equal error in the opposite direction.

Good fire discipline simply consists in rapid and correct drill under all possible circumstances, in correct loading with the ammunition ordered, in accurate laying at the proper objective, in the correct application of any corrections which have to be made at the group, as, for instance, that for group difference, and in firing the guns neither too soon nor too late.

Time is an essential point in firing at moving objects, and all drills are drawn up with the object of ensuring that the various operations shall be performed as safely and quickly as possible. It must be remembered that haste is not speed, and that rapidity of fire can only be ensured by each number doing his own work, and only his own work, quickly but without hurry.

Many details of loading are of the utmost importance; for instance,

the use of too wet a sponge, a gas-check or wedge-wad forgotten, the charge not properly rammed home, will all result in a loss of muzzle velocity, consequent loss of range, and the certain throwing away of that shot; and will probably so mislead the Fire Commander as to cause him to make a false correction for the next shot, thus throwing away that also.

As regards laying, any error in setting the sights, or in actual laying, or in not remembering to depress last, will cause errors in range and direction; again misleading the Fire Commander (or operator).

When depression range-finder is used if the Gun-Captain does not fire the gun in the precise time laid down, the Fire Commander's correction for "time of firing" will be thrown out, and as he cannot know to what cause the error was due, he will be misled as to his corrections.

This point should be impressed on Gun-Captains, that the order from the Group Officer to commence firing means that the guns are to be fired if they are properly laid (Case II.) or if the laying is completed in the proper time (Case I.) It is better for a gun to miss its turn and wait for the next prediction than to mislead the Fire Commander. Gun-layers, of course, must not give the signal that they are on, unless they are properly laid.

Group Officers must be careful to give the order to commence firing the instant the dial shows the required range, if any delay occurs the "time of firing" correction will be vitiated; they must, therefore, watch the dial closely as the hand approaches that range. Should a Group Officer become aware, after firing, of any circumstance which might render the result of the round unreliable, he should communicate at once with the Fire Commander, through the Group Commander if there is one, in order that the Fire Commander may not be misled. When group salvos are fired there is less chance of an error, in the service of an individual gun, misleading the Fire Commander; as the average result of the whole of the shots would be taken to base the correction on; and any considerable difference of one shot from the others would show that something was wrong with it; this is a further advantage of firing by salvos. This does not, however, excuse any relaxation of watchfulness over the fire discipline; under modern conditions of objects moving at high speed, and a comparatively small number of heavy guns taking considerable time to load, the number of shots that can be fired at the object is not great; and we cannot, therefore, afford to throw away ammunition. The number of shots that can be fired under given conditions can easily be calculated; for example, a 10-inch M.L. gun in a casemate is able to bear over an arc of 70°, this gun takes $1\frac{3}{4}$ minutes to load and lay; suppose a vessel passes parallel to the front of the battery at an average range of 2000 yards and at a speed of 12 miles an hour, she will cross the arc of fire in about seven minutes; therefore, if the gun was ready to fire the moment it could bear, five shots in all can be fired at her.

The necessity for superior accuracy of laying with modern ordnance is further shown, if we consider that, an error of five minutes in lay-

ing will cause an error in range at 2000 yards of

29 yards with 64-pr. R.M.L. (converted) gun.
42 „ „ 10-inch R.M.L.
100 „ „ 10-inch B.L.

These considerations make it evident that, the better the weapon, the greater is the necessity for a high standard of training, intelligence, and care, on the part of those who have to use it.

Bad shooting is sometimes caused by the racers being out of level; this when quadrant elevation is given by index plate, multipliers, or in fact by any means except some form of clinometer, will cause errors in range as well as direction. These errors should be ascertained and allowance made at the gun for them under the direction of the Group Officer. If the errors are not great an average can be struck and applied as a permanent correction; but if they are large and vary much, it would be better to always lay by clinometer or by tangent sights; of course, guns in a group must not be laid, some with tangent and some with quadrant elevation, owing to the different corrections required to be made in each case by the Fire Commander.

A couple of illustrations from actual practice may serve to emphasize the above remarks on the necessity of thorough fire discipline. In the first case a standing target was being fired at, a depression range-finder being used to find the range; the first shot as observed by depression range-finder fell 100 yards short, a correction of this amount was made by the Fire Commander; the second shot fell about 100 yards over; 50 yards was taken off by the Fire Commander, and the third shot fell 50 yards over; for the fourth shot the original range was reverted to and a hit obtained. On returning stores a wedge-wad too many was found; this was evidently omitted the first round, causing the shot to start forward in running up, and thus giving too short a range. Now in this case not only was that round wasted in which the fault of fire discipline occurred, but the next two as well. In the second case a moving target was the object, good practice was being made at it, when a temporary cessation of fire was ordered the guns being loaded and run up at the time; on resuming practice in a few minutes time, the next salvo was very short, correction was made and the next was equally over; taking off this correction again resulted in as good practice as before it was put on. The cause of this was traced to the use of too much water in the sponge tanks; for all the rounds, except that in which the pause occurred, probably an equal time elapsed, or nearly so, between the loading and firing; so that an equal powder error in each case was caused; in the round where the delay took place the water in the bore had more time to act on the powder and thus caused an increased error; and resulted in the throwing away of two salvos.

To sum up the responsibilities of various officers in action as regards the points mentioned; the Section Commander, at the commencement of an action will indicate to the Fire Commanders the objectives he wishes them to attack; pointing out the probable nature of the enemy's tactics and the general idea of the defence; informing them

EXAMPLE OF A LIST OF FOREIGN VESSELS, GIVING INFORMATION REQUIRED BY FIRE COMMANDERS, TO ENABLE THEM TO ENGAGE SUCH VESSELS.

LIST OF FRENCH ARMOURED SHIPS FOR USE OF FIRE COMMANDER OF FORT X.

HEIGHT ABOVE MEAN TIDE LEVEL 50 FEET.

ARMAMENT OF FORT X. PRIMARY. { 12·5-INCH. R.M.L. A. GROUP. / 9 „ „ B. to D. GROUP.
SECONDARY. { 7 „ R.B.L. E. „ / 64-PR. R.M.L. F. G. „
MOVABLE. 40 „ „ and Q.F. GUNS.

Type and Names of Vessels.	Draught. feet.	Length. feet.	Breadth. feet.	Short Description.	Armament.	Armour, its nature, thickness and distribution.	Ranges in Yards at which armour is penetrable. (maximum).	General Idea for attack of Vessel.
A. Type Central Battery.				Ships having a complete water-line belt and an armoured central battery enclosed by transverse armoured bulkheads; the ends above the belt being unarmoured.	Can fire 4 to 5 heavy guns ahead, 2 to 3 astern, and 4 to 5 on each broadside.	4 to 6 guns are protected; remainder partially so from end-on fire by central battery, no protection against side fire.		The unprotected armament and unarmoured ends should be the principal objects of attack, movable armament being used to keep down fire from military tops, &c.
1. { "Courbet," / "Devastation," }	27	315	63	3 masts, each with 2 military tops. 2 funnels abreast amidships, high and large; just in front of mainmast. Sides tumble home leaving battery projecting. High forecastle with bowsprit; ram bow. Sloping stern with stern walk.	Protected by armour. — 4, 34cm 48-ton B.L. in central battery. — Unprotected. — 4, 27cm; 2 in barbettes over battery; 1 at bow; 1 at stern. 6, 14cm B.L. on broadsides. 2 Q.F., 18 machine.	Belt 15 inches wrought-iron 5 feet above water-line. Battery 9·5 inches wrought-iron, 89 feet long. Bulkheads (curved) 12 inches wrought-iron at 96 feet from bow and 130 feet from stern. Deck 3 inches.	12·5 at 1600. / 9 at 0. 12·5 at all. / 9 at 1200. 12·5 at 4200. / 9 at 0. 12·5 at 0. / 9 at 0.	"A." Group. 6000 to 1000. C.p. Below 1000 P. at belt. "B." and C." C.p. to 1000, then P. at battery, unless end-on, when C.pl. "D.," C.p. to 1000 (then C.pl.)* "E." Seg. p. "F." "G." S.p. to 1000 (then S.pl.)*
2. "Redoubtable," ...	25½	318	65	Generally similar to No. 1, but only one top to each mast. Has a military gallery for machine guns running round top of funnel casing.	Same as No. 1, except that guns in battery are 27 cm 24-ton B.L.	Belt 14 inches wrought-iron 5 feet above water-line. Battery and Bulkheads 9·5 inches wrought-iron, arranged as in No. 1. Deck 2·5 inches.	12·5 at 2500. / 9 at 0. 12·5 at all. / 9 at 1200. 12·5 at 5000 least. / 9 at 0.	"A." 6000 to 5000. P. at Deck; 5000 to 1500 C.p., below 1500 P. at Belt. "B." and "C." C.p. over 1000, then P. at Battery, or Bulkhead if end-on. "D." C.p. over 1000) then C.pl.)* "E." Segment, p. fuze. "F." and "G." S.p. to 1000 (then S.pl.)*

P. = Palliser shot. C.p. = Common shell percussion fuze. C.pl. = Common plugged. S.p. = Shrapnel percussion fuze. S.pl. = Shrapnel plugged.

* Where a change from percussion to plugged shell is indicated, it is not intended that this change should necessarily be made, but only that at those ranges plugged shell would be effective and might be used.

EXAMPLE OF A LIST OF FOREI
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LIST OF FREN

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Type and Names of Vessels.	Draught. feet.	Length. feet.	Breadth. feet.	Short I
A. Type Central Battery.				Ships having line belt and ar battery enclos armoured bul above the belt
1. { "Courbet," "Devastation," }	27	315	63	3 masts, each w 2 funnels abre and large; jus mast. Sides tu battery projec castle with bo Sloping stern v
2. "Redoubtable," ...	25½	318	65	Generally sim only one top t a military galle running round ing.

t and
be the
mov-
keep
s, &c.

1000.

, then
when

.pl.)*

S.pl.)*

Deck;
1500

1000,
lkhead

C.pl.)*

0 (then

P. = Palliser shot. C.p. = Common shell

* Where a change from percussion to plugged

at the same time, if possible, the type of the vessel or vessels he has allotted to them. During the action he will not interfere usually, except by directing the Fire Commanders to attack fresh objectives as may become necessary.

The Fire Commanders, by the aid of their tables of ships, decide on the best way to attack their objectives; namely, what projectiles to use, and what part of the vessels to direct their fire upon; and regulate the trajectory of the guns; changing the form of attack from time to time as the range changes and a fresh method becomes advisable.

The Group Officers, supervised by the Group Commander, superintend the fire discipline of their groups; carrying out the orders they receive from the Fire Commander.

In conclusion it must be remembered that the subject of the proper use to be made of Artillery in Coast Defence is one that constantly receives new developments. The introduction of new weapons and improved means of fighting them; and the addition by foreign Powers of vessels of new type to their navies, continually introduce new elements into the problem; therefore constant study is necessary if we wish to keep abreast of the times.

We must not allow ourselves to relax our efforts to make our part of the coast defences as perfect as possible, from any false sense of security from attack. As has been pointed out by General Gillmore, U.S.A., in deducing the lessons to be drawn from the coast operations of the Civil War,[1] "where interests of great magnitude are at stake, ordinary prudence would suggest that as little as possible be left to the caprice of chance. . . . Fleet arrayed against fleet leaves too much to risk and accident, with our stake on the issue immeasurably greater than that of the enemy. These maxims unmistakeably point to the necessity of depending mainly for the defence of our coasts on those agencies, exclusively our own, which cannot be neutralised or duplicated by our antagonist, and will, therefore, always keep him at a disadvantage, to wit: permanent shore batteries and their accessory channel torpedoes."

"The office of permanent fortifications is chiefly to avert attack." But they can only be effective for this purpose if those who have to defend them are so skilled in the use of their weapons, as to make the attack of such fortifications a difficult and costly task.

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[1] "Battles and Leaders of the Civil War," Vol. IV., pp. 70–71.

CORRECTION TABLES REQUIRED IN CASE I.

(Viz.: when Tangent Elevation is used)

NO CORRECTION FOR TIDE IS REQUIRED.

CORRECTION TO RANGE FOR "TIME OF FIRING" (10 SECS.)

For range of	900	1300	1700	2100	2500	2800	3100	3400	3800	4100	4400	4700	5000
Correction is	When number of seconds taken for the range to alter by 50 yards is												
25	24	26	28	30	32	34	36	38	40	42	44	46	48
50	12	13	14	15	16	17	18	19	20	21	22	23	24
75	8	8½	9½	10	10½	11½	12	12½	13½	14	14½	15½	16
100	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12
125	5	5	5½	6	6½	7	7	7½	8	8½	9	9	9½
150	4	4½	4½	5	5½	5½	6	6½	6½	7	7½	7½	8
175	—	—	4	4	4½	5	5	5½	5½	6	6	6½	7
200	—	—	—	—	4	4	4½	4½	5	5	5½	5½	6
225	—	—	—	—	—	—	4	4	4½	4½	5	5	5½
250	—	—	—	—	—	—	—	—	4	4	4½	4½	5

CORRECTION TO DEFLECTION FOR TIME OF FLIGHT + TIME FOR LAYER TO GET CLEAR (4 SECS.)

For range of	900	1300	1700	2100	2500	2800	3100	3400	3800	4100	4400	4700	5000
Correction is	When number of seconds taken by object to traverse one degree of arc is—												
Mins.													
15	24	28	32	36	40	44	48	52	56	60	64	68	72
30	12	14	16	18	20	22	24	26	28	30	32	34	36
45	8	9½	10½	12	13½	14½	16	17½	18½	20	21½	22½	24
60	6	7	8	9	10	11	12	13	14	15	16	17	18
75	5	5½	6½	7	8	9	9½	10½	11	12	13	13½	14½
90	4	4½	5½	6	6½	7½	8	8½	9½	10	10½	11½	12

CORRECTION TABLES FOR USE IN CASE II.

I.—CORRECTION TO RANGE FOR STATE OF TIDE.

At Range.	900	1300	1700	2100	2500	2800	3100	3400	3800	4100	4400	4700	5000
Correction is—	When state of tide is—												
+100	High	—	—	—	—	—	—	—	—	—	—	—	—
+ 75	—	High	—	—	—	—	—	—	—	—	—	—	—
+ 50	¾	—	High	—	—	—	—	—	—	—	—	—	—
+ 25	—	¾	¾	High to ¾	High to ¾	High to ¾	High	High	High	High	—	—	—
0	Mean	Mean	Mean	Mean	Mean	Mean	¾ to ¼	¾ to ¼	¾ to ¼	¾ to ¼	High to Low	High to Low	High to Low
− 25	—	¼	¼	¼ to Low	¼ to Low	¼ to Low	Low	Low	Low	Low	—	—	—
− 50	¼	—	Low	—	—	—	—	—	—	—	—	—	—
− 75	—	Low	—	—	—	—	—	—	—	—	—	—	—
−100	Low	—	—	—	—	—	—	—	—	—	—	—	—

II.—CORRECTION TO RANGE FOR "TIME OF FIRING" (3 SECS.)

For Range.	900	1300	1700	2100	2500	2800	3100	3400	3800	4100	4400	4700	5000
Correction is—	When the number of seconds in which the range alters by 50 yards is—												
25	10	12	14	16	18	20	22	24	26	28	30	32	34
50	5	6	7	8	9	10	11	12	13	14	15	16	17
75	—	4	5	5	6	7	7	8	9	9	10	11	11
100	—	—	—	4	4½	5	5½	6	6½	7	7½	8	8½
125	—	—	—	—	—	4	4½	5	5	5½	6	6½	7
150	—	—	—	—	—	—	—	4	4½	4½	5	5½	5½
175	—	—	—	—	—	—	—	—	—	4	4½	4½	5
200	—	—	—	—	—	—	—	—	—	—	—	4	4½

III.—DEFLECTION FOR TIME OF FLIGHT.

For Range.	900	1300	1700	2100	2500	2800	3100	3400	3800	4100	4400	4700	5000
Correction is—	When number of seconds taken by object to traverse 1 degree is—												
Mins.													
15	8	12	16	20	24	28	32	36	40	44	48	52	56
30	4	6	8	10	12	14	16	18	20	22	24	26	28
45	2½	4	5½	6½	8	9½	10½	13	13½	14½	16	17½	18½
60	2	3	4	5	6	7	8	9	10	11	12	13	14
75	1½	2½	3	4	5	5½	6½	7	8	9	9½	10½	11
90	1	2	2½	3½	4	5	5½	6	6½	7½	8	8½	9½

NOTE.—Fractions of a second are reckoned to the nearest half second.

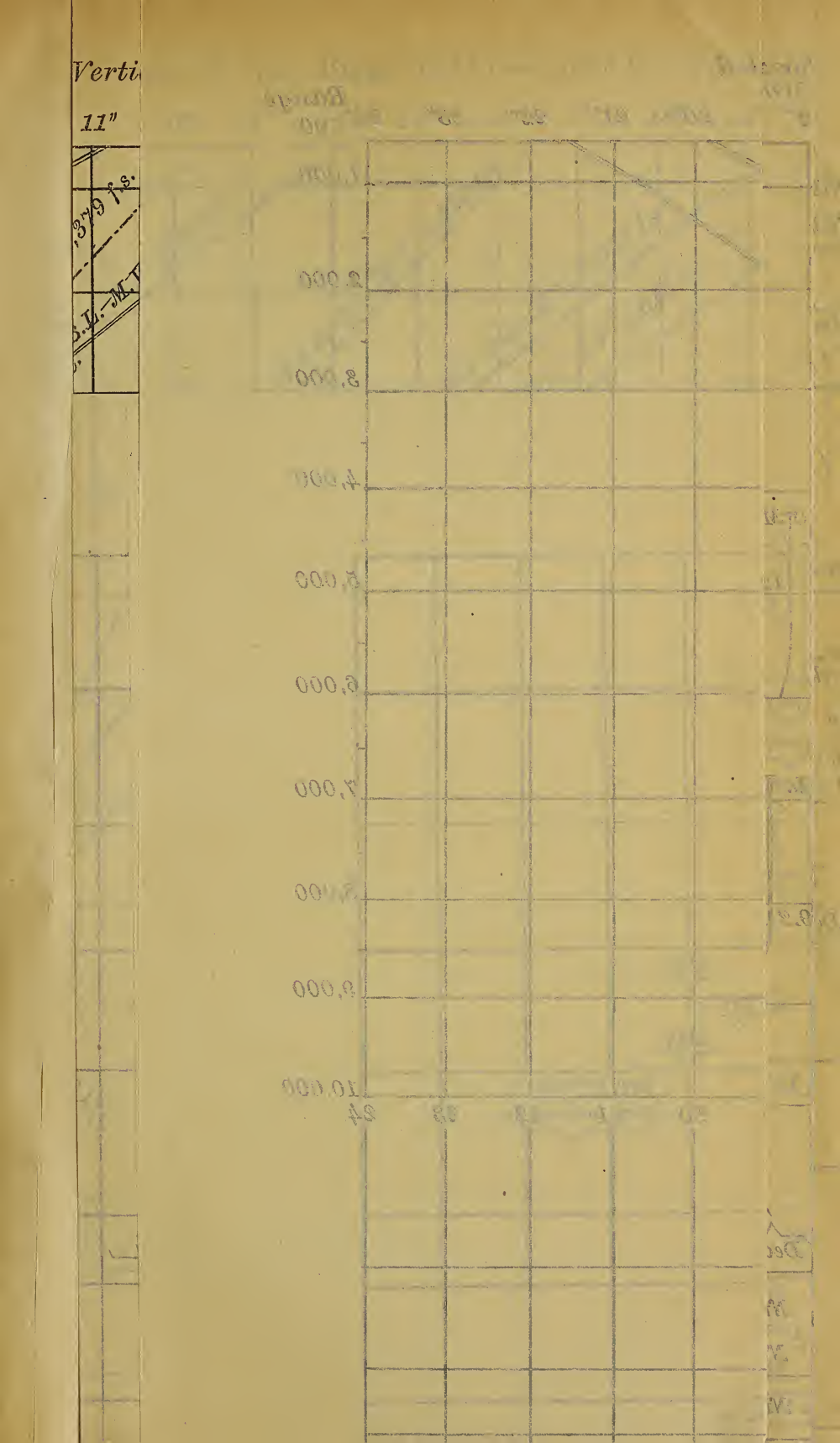
Note to tables of Fire Commander's Corrections :—These tables can only be taken as approximations, they have been amplified from those given in "Regulations for Practice over Sea Ranges, 1892." The times of flight are for 9-inch R.M.L., and the tide table for an extreme difference of level of 20 feet. Different guns and different local conditions as to tide necessitate different tables. Fractions of seconds have been reduced to the nearest half second. In range correction tables, times of less than 4 seconds need not be taken into account, as an alteration of range of 50 yards in 4 seconds implies a speed of at least 25 miles per hour.

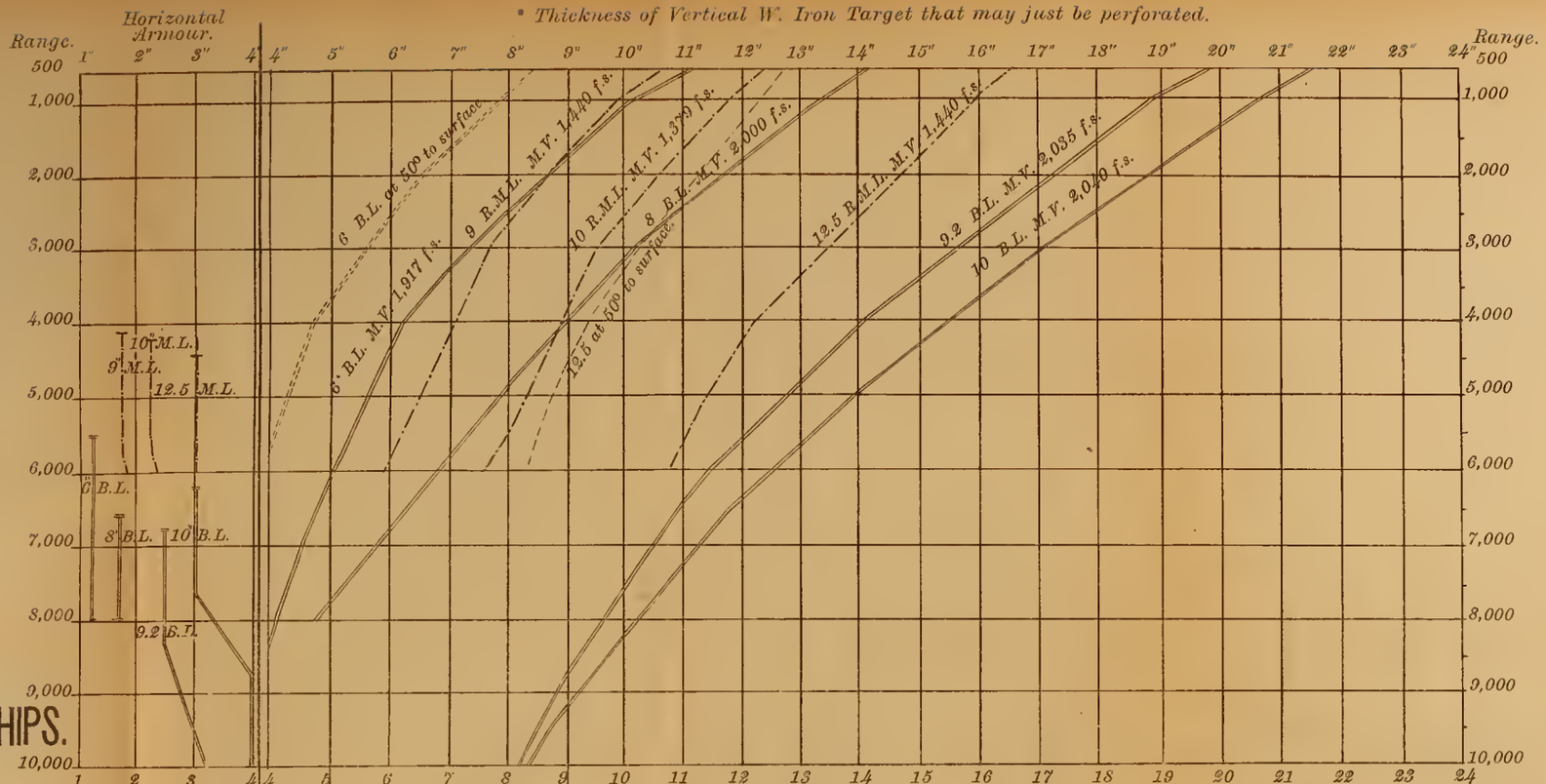
The following table is given to illustrate remarks made on the subject in the lectures.

Deflection (approximate) to shift point of impact from the bow to the centre of a ship 300 feet long, broadside-on.

For Range of .	900	1300	1700	2100	2500	2800	3100	3400	3800	4100	4400
Deflection is ...	$3\frac{1}{4}°$	$2\frac{1}{4}°$	$1\frac{3}{4}°$	$1\frac{1}{2}°$	$1\frac{1}{4}°$	1°	1°	1°	$\frac{3}{4}°$	$\frac{3}{4}°$	$\frac{3}{4}°$

The ranges being the same as those which occur in the other tables to facilitate reference.





* *These penetrations represent the maximum that may be expected, the target standing vertical and on the same level as the gun; as the height of gun over target increases, the penetration of a vertical target will decrease. The penetrations for 6" B.L. and 12.5" M.L. when the target (still standing vertical) is inclined to the line of fire 50° are shown in dotted lines. It would not be advisable to attack armour whose inclination to line of fire is unknown, unless penetration at 50° might fairly be expected.*

FRENCH ARMOURED SHIPS.

A Type. CENTRAL BATTERY.

Courbet, Devastation.			Deck								Battery & Bulkheads.						Belt							
Redoubtable.			Deck								Battery & Bulkheads.					Belt								
Richelieu, Trident, Colbert, Marengo, Ocean, Suffren.		Nil			Bulkhead.		Battery		Belt															
Friedland.		Nil			Battery & Bulkhead				Belt															
La-Galissoniere, Victorieuse (? obsolete)		Nil			Battery & Bulkheads.		Belt																	

B Type. TURRET VESSELS.

Bouvines, Jemmapes, Trehouart, Valmy.	Deck on flat (s)		on slope														Hatchways (c)		Supports to Turrets (c)		Turrets	Belt (c)	or (s)	
Charles-Martel.		Deck																		Turrets & Belt (c)				
Jaurèguiberry.		Deck (s)			Secondary Turrets											Turrets (c)					Belt (c)			
Lazare-Carnot.		Deck									Turrets (c)										Belt (c)			
Fulminant, Tonnerre, Tempête, Vengeur	Deck												Turrets		Belt & Redoubts.									

C Type. BARBETTE VESSELS.

Amiral-Baudin, Formidable.			Deck												Belt at ends		Ammn. Hoists (s).		Barbettes (s)				Belt maxm. (s)	
Amiral Duperré.		Deck			Ammn. Hoists						Belt at ends						Barbettes						Belt maxm.	
Indomptable.			Deck																Barbette			Belt		
Caiman, Requin, Terrible.*		Deck	Deck	*															Barbette			Belt		
Furieux.			Deck																Barbette			Belt		
Hoche, Marceau, Magenta, Neptune.			Deck						Ammn. Hoists (c)							Barbettes (? c)		Belt (? c)						
Tonnant.		Deck														Barbettes (? c)		Belt (? c)						
Brennus.		Deck	Deck	Covers Barbettes														Belt & Barbettes (c)						
Bayard, Dugueselin, Turenne, Vauban.		Deck					Belt at ends		Barbettes		Belt													
Aeheron, Cocyte, Phlegethon, Styx.		Deck							Belt & Barbette (c)															
Flamme, Fusee, Grenade, Mitraille.		Deck			Shield (s)				Barbette		Belt (s)													

ARMOURED CRUISERS.

Dupuy-de-Lome.		Deck			Barbettes (s)		Sides (s)																	
Bruix, Chanzy, Charny, Latouche-Treville.		Deck			5"5 Sides (s)																			

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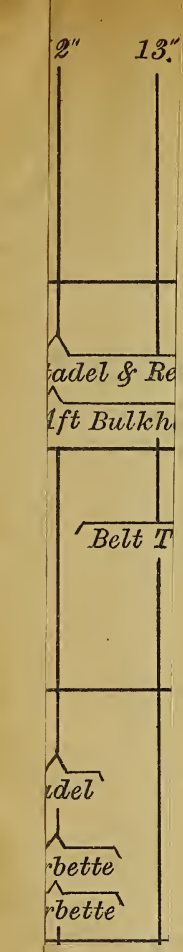
FRENCH ARMOURED SHIPS.

A Type: CENTRAL BATTERY.

Courbet, Devastation.
Redoutable.
Bouvet, Tréhouart, Gilbert, Merveilleux, Ocean, Suffren.
Friedland.


2"
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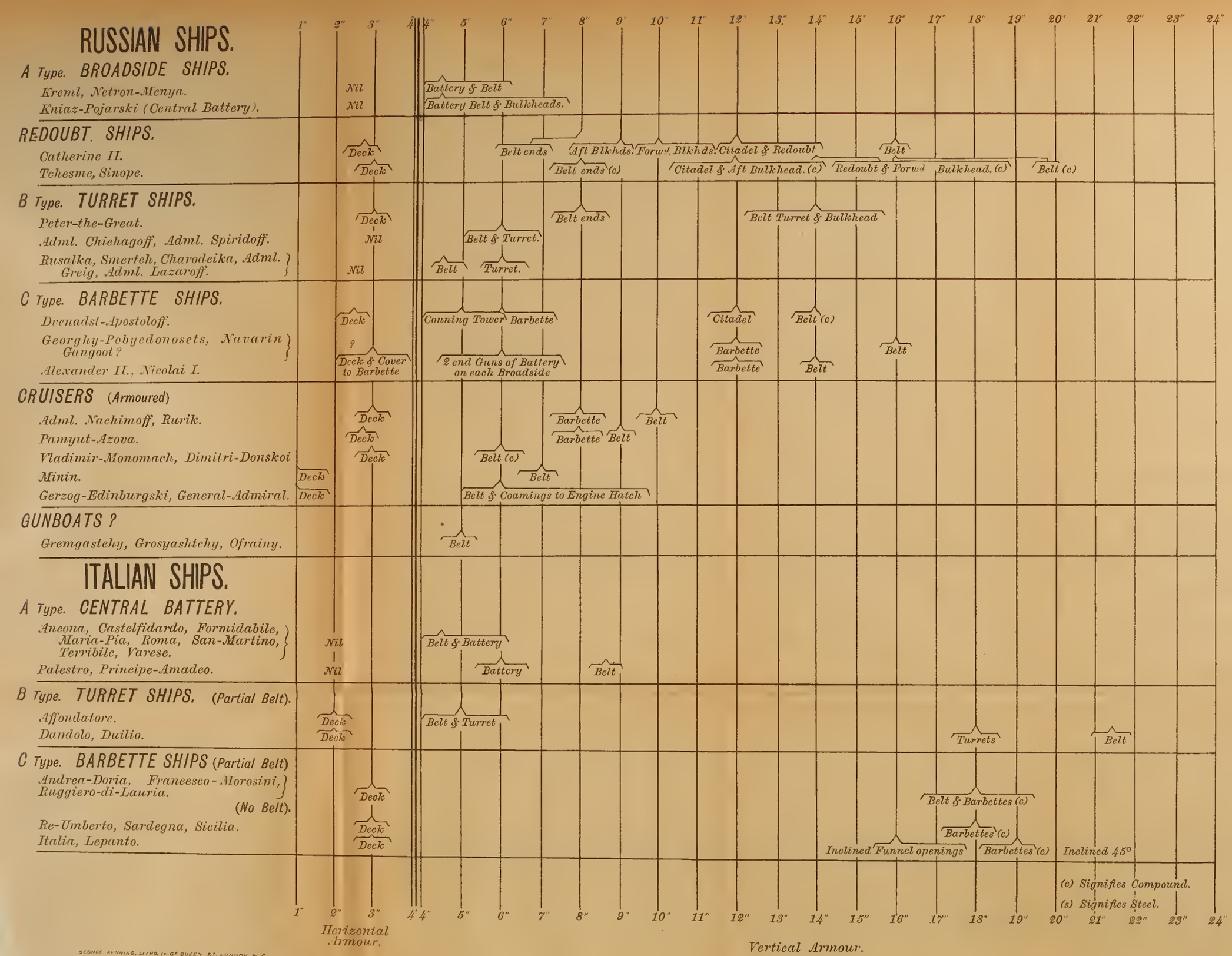
RUSSIAN SHIPS.
A Type. BROADSIDE SHIPS.
Kreml, Netron-Menya.
Kniaz-Pojarski (Central Battery).
Nil
Nil
Battery & Belt
Battery Belt & Bulkheads.
REDOUBT SHIPS.
Catherine II.
Tchesme, Sinope.
Deck
Deck
Belt ends
Aft Blkhds.
Forwd Blkhds.
Citadel & Redoubt
Belt
Belt ends (c)
Citadel & Aft Bulkhead. (c)
Redoubt & Forwd Bulkhead. (c)
Belt (c)
B Type. TURRET SHIPS.
Peter-the-Great.
Adml. Chichagoff, Adml. Spiridoff.
Rusalka, Smerteh, Charodeika, Adml. Greig, Adml. Lazaroff.
Deck
Nil
Nil
Belt ends
Belt & Turret.
Belt
Turret.
Belt Turret & Bulkhead
C Type. BARBETTE SHIPS.
Dvenadst-Apostoloff.
Georghy-Pobyedonosets, Navarin Gangoot?
Alexander II., Nicolai I.
Deck
?
Deck & Cover to Barbette
Conning Tower
Barbette
2 end Guns of Battery on each Broadside
Citadel
Barbette
Barbette
Belt (c)
Belt
Belt
CRUISERS (Armoured)
Adml. Naehimoff, Rurik.
Pamyut-Azova.
Vladimir-Monomach, Dimitri-Donskoi
Minin.
Gerzog-Edinburgski, General-Admiral.
Deck
Deck
Deck
Deck
Deck
Belt (c)
Belt
Barbette
Barbette
Belt
Belt
Belt & Coamings to Engine Hatch
GUNBOATS ?
Gremgastchy, Grosyashtchy, Ofrainy.
Belt
ITALIAN SHIPS.
A Type. CENTRAL BATTERY.
Ancona, Castelfidardo, Formidabile, Maria-Pia, Roma, San-Martino, Terribile, Varese.
Palestro, Principe-Amadeo.
Nil
Nil
Belt & Battery
Battery
Belt
B Type. TURRET SHIPS. (Partial Belt).
Affondatore.
Dandolo, Duilio.
Deck
Deck
Belt & Turret
Turrets
Belt
C Type. BARBETTE SHIPS (Partial Belt)
Andrea-Doria, Francesco-Morosini, Ruggiero-di-Lauria.
(No Belt).
Re-Umberto, Sardegna, Sicilia.
Italia, Lepanto.
Deck
Deck
Deck
Belt & Barbettes (c)
Barbettes (c)
Inclined
Funnel openings
Barbettes (c)
Inclined 45°
(c) Signifies Compound.
(s) Signifies Steel.
1" 2" 3" 4" 4" 5" 6" 7" 8" 9" 10" 11" 12" 13" 14" 15" 16" 17" 18" 19" 20" 21" 22" 23" 24"
Horizontal Armour.
Vertical Armour.
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RUSSIAN SHIPS.

4 Type. BROADSIDE SHIPS

HEAVIEST SHIPS

8 Type. TURRET SHIPS.

C Type. BARBETTE SHIPS.

GUNBOATS (Armoured)

GUNBOATS ?

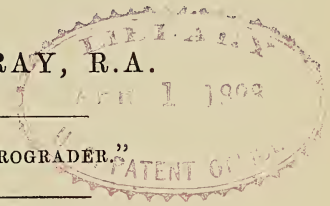
ITALIAN SHIPS.

4 Type. CENTRAL BATTERY.

FIRE DISCIPLINE; ITS NECESSITY IN A BATTERY OF HORSE OR FIELD ARTILLERY, AND THE BEST MEANS OF SECURING IT.

BY

MAJOR A. M. MURRAY, R.A.



"S'ARRÊTER C'EST DE RÉTROGRADER."

DUNCAN GOLD MEDAL PRIZE ESSAY, 1892.

PART I.

INTRODUCTORY.

"C'est ainsi Général que l'on perd les batailles. Il nous faut absolument un bon feu de canon." [1]—NAPOLEON.

The subject under discussion.

THE first part of the title of this Essay would seem to be the statement of a fact rather than a subject admitting of discussion. This fact, it is true, was brought home to Continental armies some years before it was accepted in England, but at home no less than abroad the necessity for Fire Discipline is now felt to be an imperative condition of success in future artillery fighting. No battery is allowed to go to the practice ground till the Lieut.-Colonel commanding its Brigade-Division is satisfied that it has been sufficiently trained in the principles and practice of Fire Discipline.[2] In the annual competition between batteries a considerable proportion of marks are given for Fire Discipline alone irrespective of the actual results of the shooting. Batteries are now judged by this more than by other tests of efficiency which, however necessary as a means to an end, are admittedly less so than a high standard of Fire Discipline.

Its historical consideration.

Although it is unnecessary to press this point further it seems desirable to open this Essay with a brief historical retrospect if for no other purpose than to show how the necessity for Fire Discipline has progressively increased with the gradually increasing destructive power of modern arms. Such a retrospect will serve to fix attention on the salient features of the matter before us, and will clear the ground for the consideration of the proposals which will be subsequently sub-

[1] Napoleon to Dessaix at Marengo.—Mem. du Duc de Ragusa, p. 132.

[2] Para. 9, Section LIX., "Standing Orders of the Royal Artillery, 1889," and para. 16, "Instructions for Practice, 1892."

mitted as being likely to afford the best guarantee for the maintenance of Fire Discipline in a battery of Horse or Field Artillery.

Fire Discipline training unnecessary in the days of S.B. guns.

In the days of smooth-bore guns batteries were rarely brought into action at a greater range than 800 yards.[1] Even at this range the effect was moral more than material. Decisive results were only obtained when the guns were advanced to case shot distance. Under these circumstances the necessity for what is now understood by Fire Discipline was not apparent. To lead his battery into a good position in the thick of the fight was the first and last duty of its commander. With the detailed conduct of the fire there was no cause to interfere. It was all straightforward. To get off as many rounds as possible at point blank range was the object of the men serving each gun. There never was any question as to the position of the target, or as to its nature and distance from the battery, nor was there any difficulty with regard to observation of fire.

Its modern necessity is due to the altered circumstances of artillery fighting.

The circumstances of artillery fighting are now altered. The introduction of the rifled small arm marked the beginning of the change. At the battle of Inkerman the Russian batteries were not advanced nearer than 1200 yards to the British infantry.[2] The forward tactics of Austerlitz, of Friedland, and of Wagram, were no longer possible. The rifled field gun, which was first used in the Italian Campaign of 1859, carried the change a step further. At Solferino[3] the French batteries opened fire at the previously unheard of range of 2500 yards. The war of 1866 found the Prussian artillery unprepared for its new *rôle*. The guns seldom came into action at the right time and place. When they did get into line their fire was ineffective. There had been no training in ranging, in observation of effect, and in discipline of fire.

German artillery training after campaign of 1866.

When peace was concluded German artillery officers applied themselves to the work of reform. The spirit of that work and the nature of the reforms which were made have been so graphically described[4] by Prince Kraft of Hohenlohe-Ingelfingen that they need not be further referred to here. Then were worked out those experiments in ranging and establishing the fuze for shrapnel which have since been formulated into a system. Then it was that German batteries were taught not only how to shoot, but how to manœuvre so as to give full effect to the lessons of the practice ground. The close connection between tactics and shooting became a marked feature of German artillery training between 1866 and 1870. Instruction in Fire Dis-

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[1] At Austerlitz Napoleon formed his lines with the artillery placed between the Brigade intervals side by side with the infantry battalions. At Friedland General Senarmont's guns opened fire at 500 yards, and subsequently advanced to 250 yards. At Wagram the big battery of 100 guns, which was formed to cover the attack of Macdonald's Column, was not deployed till within 600 yards of the Austrian line. At Borodino the artillery of Ney's, Davoust's, and Murat's Corps (200 guns in all) was formed along the Semenoffskoi ravine at case shot distance from the Russian batteries.

[2] Todleben attributes the ill success of the Russian artillery to the distance which the guns were compelled to keep from the British infantry fire.—Russel's translation, "Defence of Sebastopol," p. 193.

[3] "Study of Italian Campaign of 1859," by Major F. Miller, R.A.

[4] "Letters on Artillery," by Prince Kraft Zu Hohenlohe-Ingelfingen; translated by Lieut.-Colonel Walford, R.A. Chap. VIII.

cipline was not confined to the gun park, nor even to the practice ground, but was especially insisted on in the field. It is perfectly true, as Colonel Maurice has recently stated,[1] "that the German artillery had never fired off a gun which had not been properly laid at an assigned object with the range determined, the nature of projectile declared, and the fuze to burst the shell so far fixed that had it been necessary actually to fire in earnest every man would have gone through an almost exactly similar experience."

Results obtained in campaign of 1870-1.

The value of this peace training received practical proof in the war of 1870, when, owing to good handling and good shooting, the German artillery achieved successes as conspicuous as were its failures in 1866. The Emperor Napoleon III. attributed his defeat at Sedan mainly to the superiority of the German over the French artillery. Not less decided was the opinion of the German General Staff as expressed in the official account of the war.[2] "The German artillery at the battle of Sedan produces an especially grand and decisive effect." What it is important in this connection to notice is that the cause of this success was due to the painstaking efforts made by German artillery officers to train their men in the practice of Fire Discipline during peace. "I could hardly have believed," writes Prince Kraft, in allusion to a splendid instance of Fire Discipline on the part of a battery at the battle of Gravelotte, "that the instruction given in peace would have borne such excellent fruit in spite of the excitement of action."

Increased necessity for Fire Discipline training since 1870-71

Much has happened since 1870 to increase the necessity for Fire Discipline. Every Continental country, including England, has rearmed its artillery. The range of field guns has been lengthened; their accuracy and shooting power improved. The destructive effect of projectiles is greater, and the means of firing them more certain. In our own service a telescopic sight has been introduced which adds to the power of the gun, but also to the difficulty of training the layer. The invention of smokeless powder has removed a formidable obstacle to the sustained fire of large masses of concentrated guns. The fire of artillery will now be more continuous, entailing a heavier strain on the nerve and endurance of the *personnel*. The supply of ammunition is a problem of uppermost difficulty. The proportion of guns to infantry has been raised, and according to expectation artillery will be brought on to future fields of battle in far larger numbers than has ever before been the case. All these developments

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[1] "War," by Colonel J. F. Maurice, C.B., R.A.

[2] "So annihilating was the fire of the artillery that the French were scarcely capable of any organised resistance when the German infantry towards 3 p.m. moved forward."—German Official Account of the War of 1870-71.

The Russian, Baron Seddeler, in allusion to the action of the German artillery during the campaign wrote as follows:—

"The artillery gained an independence which even exceeded the boldest aspirations of artillerists. It is scarcely possible to have effected more than was done by the artillery. . . . The numerous victories must be ascribed to the German artillery."

The Austrian, Major Rosinich, wrote very much to the same effect in his report on the war. "The principal share in the conquest of the French in all battles must be ascribed to the German artillery."

call for increased severity of Fire Discipline, and increased training in fire tactics.[1]

Meaning of Fire Discipline.

In what does Fire Discipline consist? What are its chief attributes, and its most marked characteristics? It is easier to explain than define them. Fire Discipline may be said to be the outcome of organisation, training, and *morale*, which are of such a nature as to ensure under all possible conditions of war service complete control above and complete obedience below. In its practical application to the subject of this Essay it is the means by which an accurate, sustained, and controlled fire can be rapidly opened and continuously directed on a given tactical point in the enemy's position. Training in Fire Discipline has for its object to produce a machine—a living machine—so constructed that its action will never fail, and so directed that it can be adapted unhesitatingly, mechanically, obediently, to meet the sudden and always changing conditions of a modern battle.

Arrangement of the subject under discussion.

How can this object be secured? What in the first place is the best organisation (Part II. of this Essay) for maintaining control and obedience in a battery of artillery? What secondly is the system of training (Part III. of this Essay) most likely to ensure discipline of fire? Lastly, to what extent is the question affected by considerations of *morale*? (Part IV. of this Essay).

PART II.

Organisation.

"The battery is the unit of artillery. All other organisation is accidental. It is by batteries that artillerymen make war."[2]—Duncan.

The organisation of the battery must be first considered.

Organisation comes before training. Skilful teaching, smart drill, superior leading, have no value unless they are brought to bear on a sound system of organisation. It is necessary, therefore, to examine the construction of the battery before attempting to discuss the best means of using it. What considerations have determined its size, its division into parts, and its proportion of subordinate officers? What are the functions of the various officers, their relation to the Commanding Officer and to one another, and how are their duties allotted so as to give to each an adequate share of work and responsibility?

The battery of 6 guns is the unit of horse and field artillery.

The battery of six guns is the unit of Horse and Field Artillery. Eight guns are too many for efficient command; four too few for effective fire. Since 1804 the war strength of English batteries has always been six guns. The same number of guns are given to batteries in all other European countries, except only in the Russian and Austrian armies which have batteries of eight guns.[3]

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[1] "Discipline of fire is becoming more difficult than in 1870, and unless that discipline has improved the want of discipline will counteract the increased destructive power of arms."
Lecture by Colonel Lonsdale Hale on the "Spirit of Tactical Operations."—Aldershot Military Society, April, 1888.

[2] "History of the Royal Artillery," by Major F. Duncan, R.A.

[3] Admittedly in order to economise the number of officers. Their Horse Artillery Batteries, however, have six guns only.

Consideration of proposals to increase the size of the unit.

Schemes have been frequently put forward on paper[1] for altering the size of the unit. It has been proposed, for instance, to create a big battery of 16 guns divided into four 4-gun troops. This battery would be commanded by a Lieut.-Colonel or a senior Major. Besides two additional Majors to "superintend," the Commanding Officer would have as assistants an Adjutant, a Riding-Master, and a Quarter-Master. The proposed organisation would thus be assimilated to that of a regiment of cavalry or battalion of infantry. Those who advocate this system do so on the ground that it would consolidate control, facilitate administration, and secure uniformity.

False views upon which these proposals are based.

Reflection will show, however, that this and similar schemes are based on a misconception of the principles which should determine the size of the unit. Questions of this nature are settled by practice not by theory. The tactical needs of the case must be first considered. What is the greatest number of guns that can be controlled and manœuvred by one hand and one voice? The experience of war has fixed this number at six. No larger number of guns provided with the requisite supply of ammunition can be brought collectively and simultaneously into action in the same place under the executive command of the same leader. Symmetry, uniformity, and convenience of administration are minor considerations, which must be made to fit in as best they can with the tactical necessities of the case. It is because they have been placed first in the schemes alluded to that such proposals have gone no further than the paper on which they are printed.

Individuality of the battery an important factor in the maintenance of Fire Discipline.

The individuality of the battery is a factor of extreme importance in the maintenance of Fire Discipline. A battery should be self-supporting. There should be no leaning on outside help. The extraneous assistance of special instructors is to be deprecated. A cardinal characteristic of Fire Discipline is that it must be self-taught. If a battery cannot teach itself no one else can do so, and it is certain that Fire Discipline will be found in no battery where it is not the outcome of internal exertions made within the ranks of the battery itself.

Administrative unity of the battery.

The administrative unity of the battery is another point of importance. It is sometimes said that a Battery Commander is too heavily weighted with administrative work, and that if relieved of this he would have more time for the duties of executive command. The expediency of such relief, however, is exceedingly doubtful. Command and administration go hand in hand together. Administrative responsibility increases the labour, but strengthens the hands of the Commander. The close relations into which he is brought with his officers and men enable him to personally influence those under his command in a way which would not otherwise be possible.[2] The direct bearing which such influence has on the maintenance of discipline

[1] Three such schemes differing in detail but agreeing in principle are now in possession of the writer.

[2] The circumstances are less favourable in a regiment of cavalry or battalion of infantry where, owing to the large size of the unit, the personal influence of the Commander is less direct, and has to work through subordinate channels before it reaches the individual soldier.

under fire will be understood by all who have studied the causes which contributed to the success of the Germans in 1870.[1]

Its division into sections.

The division of the battery into three sections gives a distinct charge to each subaltern officer. In no other branch of the army are the conditions so favourable for decentralising authority. The tendency in recent years has been in the direction of increasing the responsibility of the Section Commander. In the last edition of the "Standing Orders of the Royal Artillery," Battery Commanders were directed to "work through the subalterns of sections," who are now held responsible for the instruction[2] of their men as well as for the interior economy of their sections. The section has now become the sub-unit for instruction. How admirably adapted this organisation is for the purposes of Fire Discipline training will be shown in Part III. of this Essay.

Importance of the section system.

Just as each battery should be self-supporting so should each section, and after the section each sub-division. Recruits when once posted to a sub-division should not be moved from it except under strong necessity. The lower decentralisation is carried the better. The encouragement of *esprit de corps* should by no means be limited to the battery, but requires to be carried as far down as possible in the scale of organisation. If a Section Officer sees his men constantly changing, his interest in those who remain is correspondingly decreased. The more permanent the union between the officer and those under him during peace the more likely is discipline to be maintained under fire.

Battery system admirably adapted for securing Fire Discipline.

It is not possible to pass from this part of the subject under discussion without a strong sense of satisfaction. We have in the battery system an organisation which offers the best conditions for securing control above and obedience below. The mechanism of an English battery, whether taken as a whole or dissected in parts, will bear the test of close comparison with that of any foreign model. The German battery with fewer officers is a less perfect machine. If the Fire Discipline of an English battery falls below the requisite standard of excellence this is not due to want of organisation, but must be looked for in other causes, such as faulty training, or imperfect *morale*.

PART III.

Training.

"*Untiring practical instruction is needed in all that goes to make up the end of shooting. Without it all other excellence is worthless.*"[3]—Fox Strangways.

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[1] In alluding to this question of administrative responsibility the late Colonel Home, R.E., wrote as follows:—

"As the provision of food, arms, and clothing for men keeps the superior in contact with the inferior, and induces the latter to lean on, be governed, and be guided by the former, it follows that if possible the first tactical division should correspond with the first administrative division, or in other words that the smallest independent tactical command should also be the smallest administrative division."—Précis of Tactics, by Colonel Home, C.B., R.E.

[2] "They are to instruct the men of their own sections in their duties as artillerists."—Para. 2, Sect. XVI., "R.A. Standing Orders."

[3] "Field Artillery Progress," by Lieut.-Colonel Fox Strangways, R.A., "Proceedings" of the R.A. Institution, Vol. IX., March, 1876.

Importance of systematic training throughout the year.

The first necessity for training is that it should be systematic. Spasmodic drill parades will not secure Fire Discipline. A connected course of instruction extending throughout the year and progressive from day to day is necessary for every battery. The system of training must depend on the system of recruiting. In India the conditions are more favourable than in England. Recruits are sent out periodically in batches and remain for definite and known periods with their batteries. In England they are received in driblets, and the duration of their service in a particular battery is uncertain. In spite, however, of these difficulties it is quite possible to establish an annual course of instruction which can be followed without interruption. The limits of the Indian draft season may be said to be between the 1st October and the 1st of March. After the latter date and before the next succeeding October there is no risk (under normal conditions) of disturbance of the *personnel.* It is known at the latest by the 1st of March every year what men will remain with each battery for practice in the summer and for manœuvres in the autumn.

All training should be preparation for the annual manœuvres which are the final test of Fire Discipline.

As on the Continent so with us, the institution of combined manœuvres of the three arms during the autumn is now recognised as an annual necessity. All training should be preparation for these manœuvres which are the crowning test of the work done during the year. Successful shooting is not a conclusive proof of Fire Discipline: because even at Okehampton the tactical test, owing to the limited ground available, must of necessity be imperfectly applied. The true, searching, final test of the Fire Discipline of a battery must be looked for in the field at such manœuvres as were carried on in 1890 on the Berkshire Downs, and last year in Hampshire, at the Curragh, and on a smaller scale in other districts.

Training during winter months.

The winter months in England are best given up to individual training. By fixing all courses of instruction outside the battery during this season young officers and non-commissioned officers will not be taken from their batteries during the progress of the summer instruction. As soon as the requirements of the Indian drafts are known it should be arranged without delay for the transfer to the depôt of all men selected for foreign service—the place of these men, as likewise of all those whose time will expire during the ensuing year, being filled by recruits. There is no object in keeping at the depôt recruits who are not eligible for Indian service during the current trooping season. On the other hand, it is very inconvenient to receive recruits in service batteries after the 1st of April when once the battery has been committed to its summer drills. The earlier they come during the winter the better so that they may get started and their individual training taken in hand before the drill season begins. The conditions in England do not after all differ so widely as is sometimes supposed from those on the Continent where all recruits who come up in November are expected to take their place as trained soldiers during the succeeding autumn manœuvres.

Young officers.

The training of subaltern officers on first joining must here be referred to. The duties which are now assigned to them of instructors require that they should in the first place be thoroughly trained them-

selves. Their best school is their battery[1]; their best master is their Major. He is more concerned that anyone else in their efficient training, and the greater pains he takes to secure this object the greater will be his subsequent advantage.

Advantage of training them in their own batteries.

Formerly, young officers on first receiving their commissions were sent to Woolwich and Shoeburyness for courses of drill and lectures; but in recent years they have joined their batteries direct. This system gives the best guarantee for rapid progress. With his battery the young officer has every incentive to industry. The eyes of all are on him, and it is his object to acquit himself creditably before those over whom he is to be placed. The necessity for exertion comes home to him in a manner which is not possible when he is one of a large batch of young officers brought together for a course of training under an instructor who has no direct responsibility for their future career.

Practical course of instruction lasting for three months.

The course of instruction which is laid down in the "Regimental Standing Orders"[2] should be thoroughly applied—the young officer falling in with the young non-commissioned officers and recruits of his battery. Before dismissal he must show not only that he knows his drill but that he is able to instruct others in it. He will not learn by looking on at drill squads. He must accompany the battery into the field, taking in turn the duties of each number, and learn how to lead a sub-division before he takes command of his section. The more practical his training is made, the greater confidence will he subsequently acquire. Experience shows that with the present general and technical education received at the Royal Military Academy a young officer does not require more than three months in which to learn all that is at first necessary to give him a start in his battery. This does not mean that his military education is complete, but merely that he has acquired sufficient practical knowledge to enable him to take his place at the head of his section as its responsible leader.

Vital necessity for recruits being trained in their batteries.

The recruit as well as the officer should be trained in his own battery. At stations where two or more batteries are concentrated to form a Brigade Division attempts have sometimes been made to organise the instruction of the recruits under the Adjutant. The arguments used in support of this system are that as recruits join batteries by twos and threes it is a waste of power to employ several officers and non-commissioned officers in drilling them when one can do the work. By massing the recruits of several batteries under the Adjutant or Orderly Officer (assisted by the sergeant-instructor in gunnery) the time of instructors is economised, and greater uniformity in drill is obtained. Plausible as these arguments appear they are directly antagonistic to the views put forward in this Essay. They strike, indeed, at the very root of the battery system. Training in

[1] Under existing orders (paragraphs 29 and 30, Section III., "Standing Orders of the Royal Artillery") "the organisation of the young officers' instruction rests with the Lieut.-Colonel Commanding." The delegation to the Battery Commander of the duty of executive instructor is not inconsistent with the spirit and intention of this order. At out stations this delegation must be the rule, and generally at stations where batteries are concentrated it will be found desirable to make it so. The earlier the young officer and young recruit establish their connection with their battery the better.—"It is by batteries that artillerymen make war."

[2] Paragraphs 30 and 31, Section III., "Standing Orders of the Royal Artillery, 1889."

Fire Discipline begins and continues from the day the recruit joins his battery to the day he passes to the reserve. He should be taught, therefore, to look to his battery not only for pay, clothing, and food, but for instruction in his duties as a soldier. This instruction should be carefully directed by his own officers, and not delegated to any one else. When the recruit first joins he is more impressionable than at any subsequent period, and if taken in hand at once by his own officers they will acquire a hold over him which will rarely be lost.

Annual course of instruction.

The drill season properly so-called begins on the 15th of March. By that date officers, non-commissioned officers, and men have all returned to their batteries. Every battery should then begin the season with a complete course of instruction in drill and Fire Discipline. For this purpose batteries in turn should be taken off regimental and garrison duties so that all may be present. During this period the battery should be absolutely at the disposal of its Commanding Officer. The duration of the course should be for one month. A lesser period is not sufficient for all the work that has to be got through. The method of taking sections of batteries off duty at a time does not meet the necessities of the case, which requires the entire battery to be trained simultaneously under the personal executive supervision of its own chief instructor. There should be no "casuals" remaining to be taught when the course is finished. The object of the course is not to put non-commisioned officers and men through so many hours of mechanical drill, but to train the battery as a whole in the practice of Fire Discipline—each individual taking the place he will occupy during the subsequent annual practice and autumn manœuvres.

Functions of the Battery Commander as Chief Instructor.

It is the function of the Battery Commander in his capacity as chief instructor to draw up a syllabus of instruction to be followed during the course. In this matter he should have full latitude [1] consistent with the ultimate end in view. Uniformity in instructional work is impossible. So much depends on the circumstances of each case. Methods which are known to lead to good results in one battery may be found to be inapplicable to another. Far from fixing a limit to the range of their efforts Battery Commanders should be encouraged to develop the system of training which they may find best adapted to the case of their own batteries.

Suggestions for a programme.

In a battery which obtained full marks for Fire Discipline last year the following is an outline (details being omitted) of the programme as arranged and executed. It will be seen that full advantage is taken of the battery organisation by sub-divisions and sections—the programme being based on the principle of decentralising responsibility, and of gradually working up by progressive steps from the individual gunner to the Battery Commander.

1st Week.—Sub-divisional drill.

During this week each sergeant in charge of a sub-division (under the direction of his Section Officer) placed his men and selected his layers,

[1] "It is much better not to lay down a minute system of instruction. The Commanding Officer of a battery is the proper instructor of his battery. He should be held responsible for results without fuss as to the manner of his getting them. Let him clearly understand that his reputation depends on it and leave him free."—"Field Artillery Progress," by Lieut.-Colonel Fox Strangways, R.A. "Proceedings," R.A.I. Vol. IX.

fuze numbers, and reliefs for these numbers to provide for casualties. He then drilled and re-drilled his men till they were able to perform their duties with mechanical precision. The direction and organisation of the work was in the hands of the Section Officers, while the actual drill and verbal instruction was left as far as possible to the sergeants. The officers chiefly occupied themselves in watching, making notes, and in examining young non-commissioned officers and gunners in drill, and in setting fuzes and the telescopic sight.

2nd Week.—Section drill.

During this week the instruction was entirely under the subaltern officers—each taking personal command of his two guns, and repeating with his section what the sergeants had previously done with their subdivisions. The instruction was not confined to the gun park, but each subaltern officer took his section into the field for the purpose of practising elementary tactical movements. At the end of this week the Battery Commander examined each section working under its own officer.

3rd Week.—Instruction in the gun park under the Battery Commander.

During this week the battery was drilled as a whole in the gun park under the personal command of the Major. The nature of the work done was as follows : repeated ranging, sudden changes of target, moving target drill, reduced numbers, casualties, examinations in fuze setting and telescopic sights.

4th Week.—Instruction of the battery in the field under the Battery Commander.

During this week the battery was taken out daily for practice in precise drill for half-an-hour each day and subsequently in manœuvre tactics.[1] The points to which attention were chiefly given were coming into action rapidly from preparatory positions, placing limbers and wagons, the supply of ammunition under varying circumstances, changes of target in action, moving target drill, advances to fresh positions, and other tactical work. The actual ammunition was always brought up and fuzes set precisely as would be done on service. The instruction was repeated again and again till the same regularity was obtained in the field as in the gun park, and until the necessity for direction during the progress of any particular exercise was no longer apparent. At the conclusion of the 4th week there was an examination of the battery by the Lieut.-Colonel Commanding the Brigade Division.

Necessity for course being continuously carried on without interruption.

The course described above was the solid foundation on which the annual training of the battery was based. The value, however, of this and similar courses depends on their being progressively carried through

[1] The necessity for maintaining strict Fire Discipline during manœuvres, and for the simultaneous training of the battery in tactical as well as technical knowledge, is now strongly insisted on by all senior officers of the Regiment. In a recent address to artillery officers at the Practice Camp at Delhi this year Lord Roberts drew particular attention to this point. "At every drill parade of the battery one or more positions should be taken up for coming into action under service conditions with regard not only to the selection of the positions and the manœuvring of the batteries up to them, but to the carrying out of all details. Shells and cartridges should be brought up to the guns, fuzes bored and set, the guns accurately laid, puffs of powder burnt to test the observation of fire, and spare numbers told off for the service of ammunition."—Extract from speech of Lord Roberts.

from beginning to end. Every temptation to interrupt the course should be steadily resisted. If hurried or pushed aside to make room for premature field days the work of preparation will be correspondingly checked. Drill comes before manœuvre, and if a battery attempts the latter without being thoroughly grounded in the former defective Fire Discipline will certainly be the result.

Instruction of battery commanders.

The Battery Commander requires[1] instruction in Fire Discipline as well as those under him. A battery may be well trained in Fire Discipline on its own selected drill ground, and yet fail in manœuvre through want of tactical experience on the part of its leader. This experience can only be gained by manœuvres of two or more batteries together under their Lieut.-Colonel. It is very important that batteries should be exercised in these manœuvres for at least a fortnight before they go to the practice ground. The artillery tactical exercises established by Sir Evelyn Wood at Aldershot may be taken as a type of the kind of instruction which is required. Batteries should be worked against one another as opposing forces or massed against a marked enemy for the attack and defence of artillery positions. The schemes should be set by the Lieut.-Colonel and the Battery Commanders receive their orders from him as they would do on active service. At the conclusion of each day's work there should be a conference on the ground presided over by the Lieut.-Colonel, who would elicit information on doubtful points, and generally criticise the operations. The main object to be kept in view would be the tactical training of the Battery Commanders so that they might acquire the habit of rapidly executing superior orders while maintaining in their batteries the same correct Fire Discipline as when working alone.

Application of training to the practice ground.

The battery would then be ready for the practice ground, where it applies under service conditions the instruction it has received at its station. If this instruction has been carried out on the right lines its application on the shooting range should require no greater effort than was exerted during the period of preparatory drill. Every individual will have been so perfectly trained as to be able to perform his part with unfailing regularity. Beyond this point discussion is not now invited. What may be the most practical system of field firing for testing Fire Discipline, by what means the fire of massed batteries can be best controlled by the superior Artillery Commander, what are the most approved manœuvring formations for the attack and defence of artillery positions, how batteries should be brought into the fighting line—these and other cognate questions may well form the subject of future investigation, but they do not come within the limits which the Committee have assigned to the present inquiry.

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[1] Colonel W. F. M. Hutchinson, Camp Commandant at Glenbeigh, writes as follows on this point:—"While there is no question that great credit is due to commanding officers for the satisfactory progress made by their batteries since last year, their own improvement in ranging, observation of fire, and fire tactics generally, though tangible, is not so eminently satisfactory as that which they have imparted to their commands. . . . . The time would seem to have come when it is imperative to give Battery Commanding Officers increased facilities for personal improvement."—Report on the Annual Practice at Glenbeigh, 1391.

PART IV.

"Morale."

"We must teach our men to be soldiers, and we must teach them gunnery; but let us remember that when we teach them gunnery we are no more teaching them to be soldiers than if we taught them how to make the gun instead of how to use it." [1]—Williams.

The bearing of *morale* on Fire Discipline training.

Good organisation and careful training are not sufficient to ensure Fire Discipline in a battery. Sound healthy *morale* [2] is likewise a necessity. During a long period of peace the contingency of war growing more and more remote there is a natural tendency to develop the *"forces réeles"* to the exclusion of the *"forces morales."* Yet according to Napoleon's [3] estimate the latter count in time of war for three times the worth of the former. Whatever value may be attached to this opinion the relative proportion between the two has certainly not decreased since the comparison was made. Science has altered the conditions of fighting, but it has not changed human nature. It is not easier to face death now than it was in the time of Napoleon. The high qualities of nerve and endurance which so distinguished British artillerymen during the Peninsular War [4] are just as necessary as ever, and their development should undoubtedly be placed above all other considerations of training. "We must teach our men to be soldiers."

Moral training.

Moral and physical training should be carried on *pari passu*. This is why the necessity for the recruit being trained in his battery was strongly put forward in Part III. of this Essay. The moral side of his military duties should be placed before him from the very earliest period of his career. Opportunities for doing this will occur in the intervals between drills when the mechanical drudgery, which he has at first to experience, can be relieved by oral instruction. This part of his training, however, must not be confined to formal instruction. To impress him with ideas of duty, honour, self-respect—in other words to cultivate his *morale*, should at all times both on and off parade be the first work of his officers under whom he will have to stand if the final test of war service has to be encountered.

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[1] Extract from a paper entitled "Skill-at-Arms," contributed to the "Proceedings" of the Royal Artillery Institution, by Lieut.-General Sir W. J. Williams, K.C.B., R.A., October, 1891.

[2] The word "*morale*" is here used not in the strict interpretation of its literal English translation, but as a substantive in the same sense as Napoleon frequently used the corresponding adjective.

[3] "A la guerre les trois quart sont des affaires morales. La balance des forces réeles n'est que pour un antre quart."—Napoleon's Correspondence, 1809.

[4] "Les canonniers anglais se distinguent entre les autres soldats par le bon esprit qui les anime. En bataille leur activité est judicieux, leur coup d'œil parfait, et leur bravoure stoïque."—Histoire de la guerre de la Peninsule, par le Général Foy.

Moral authority of officers.

The *morale* of a battery depends in a great degree upon the influence of the officers. "Discipline under fire," wrote Skobeleff,[1] fresh from the experiences of Plevna, "is established by moral authority of officers over their men." To gain moral authority officers must first of all know their men. The importance of their closely directing the drill of recruits has already been dwelt on. Their efforts, however, must extend beyond parade. The institution of sports, games, tournaments, and similar amusements, in which all ranks join together is an indirect means of strengthening the bonds of discipline. Such exercises promote the physical training of the body, and bring officers and men together under conditions most favourable for mutual intercourse.

The importance of education as a means to Fire Discipline.

The mind must be trained as well as the body. To be a good all-round gunner a man should at least be able to obtain a 3rd class school certificate. Without this rudimentary knowledge the task of instructing him in such duties as setting fuzes and telescopic sights becomes exceedingly difficult. If the mind has been trained by previous education the acquisition of drill and knowledge of gunnery is rendered easy. Education has, in fact, become so important a factor of the problem of Fire Discipline training that the question arises whether it ought any longer to be left to the voluntary efforts of individual recruits.[2] It is very desirable that a standard of education should be insisted on as a qualification for all gunner recruits before enlistment. If this is not thought to be practicable compulsory attendance at school might be required until the recruit has obtained a 3rd class certificate. The substitution of garrison for regimental schools—a step which was taken in 1887 for reasons of economy—has been attended with disappointing results. Where there are large classes of 40 and 50 men it is impossible to give sufficient individual attention to all. The institution of battery schools, if this could be effected, would be an excellent means of affording the necessary instruction. In education, as in other matters, decentralisation is the key to success.

Smart turn out is as essential as ever.

Artificial aids to *morale* should not be neglected. British batteries of artillery have always had a high reputation for turn out, marching past, and precise drill. It is exceedingly important that there should be no relaxation in this respect.[3] Regard for appearance encourages *èsprit de corps*, and stimulates personal pride. The value of these qualities in maintaining discipline cannot be over-rated, and is increased rather than lessened by the severer standard of Fire Discipline which is now exacted. There is fortunately no reason to think that there has been any falling off in this respect. Speaking at a meeting of the Aldershot Military Society the present Deputy-Adjutant-General of the Royal Artillery recently dwelt on the necessity for maintaining the

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[1] "Skobeleff," by Nemirovitch-Dantchenko.

[2] The argument put forward for abolishing compulsory school attendance in the army was that owing to the progress of the Elementary Education Act recruits join with sufficient educational knowledge. A boy, however, who leaves school at 13 and enlists at 18 will, in the five years interval, have forgotten the most part of what he had learnt unless his education had been kept up. Three months attendance at a military school would recall to his mind his former knowledge.

[3] "The grand parade is the best touchstone for the discipline and obedience of the troops."—Prince Kraft zu Hohenlohe-Ingelfingen.

existing standard of smartness. "My experience," said General Markham, "has been that a battery which has well-groomed horses and polished harness shoots better than a battery which has not; and I have generally found that where there is no polish there is no efficiency in other respects." [1]

The institution of badges for prize winning batteries.

An increased impetus to Fire Discipline training has been given by the institution of battery prizes, carrying with them the badge of success on the arm. Distinction is rightly and eagerly sought after by all soldiers, and the fact that these distinctive badges can only be gained after a severe competitive trial is a strong incentive to industrious preparatory training. It is suggested that this incentive would be still further strengthened if the officers of prize winning batteries were allowed to wear badges as well as their men. The burden of instruction chiefly falls upon them, and permission to wear the badge would be equally valued as the reward of success.

The power of command a moral gift.

An able writer [2]—a member of this institution—has recently pointed out that the last word on Fire Discipline will depend on the "power of command" possessed by the battery leader. There is no doubt that this is so, and that however well drilled a battery may be, however good its general state of discipline, unless its Major "knows how to command," it cannot hope to win success. The power of command is a moral gift more or less developed in each individual. Like all other natural talents it requires practice to bring it to perfection. This practice is a necessity for those who possess the gift in a high degree equally with those who are less endowed with it by nature. The organisation of a battery (as explained in Part II. of this Essay) enables subaltern officers to be trained in habits of command from their earliest days. It only remains for Battery Commanding Officers to take care that the delegated responsibility which they confer on their Section Officers is habitually exercised, and is none the less real because necessary limits are placed to its extent.

The lessons of the past.

Much has been said in this Essay about the altered conditions of modern war. While we recognise the necessity for change we must not neglect the experience of the past. That experience shows that Fire Discipline depends much more upon moral causes which are permanent than upon physical considerations which are subject to periodical change. Many lessons in Fire Discipline can be learnt by studying the records of batteries during the Peninsular War. The fact that those lessons require different application now to what they did then does not detract from their present value. If the spirit which animated our predecessors is inherited by the present generation of artillerymen there will be no difficulty in adapting it to meet the alterations which the progress of science has rendered necessary in the tactics of the past.

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[1] Lord Wolseley, then Adjutant-General, speaking on the same subject at the same meeting, expressed a similar opinion. "I would say that a battery which could shoot well would most probably also be smartest in appearance."

[2] "Field Artillery Fire," by Captain W. L. White, R.A., "Proceedings" of the R.A. Institution, Vol. XIX., page 131.

Conclusion.

It is impossible to give a conclusive answer to the question asked in the title of this Essay. Great as the progress in Fire Discipline training has undoubtedly been during the past few years improvement must still be sought for. The means which may seem best to-day for securing Fire Discipline in a battery may be superseded by other methods to-morrow. How true this is can be seen by comparing one with another the successive annual "Instructions for Practice," which have been issued since 1888 when training in Fire Discipline began to be systematically practised. Year by year fresh developments suggest themselves, and fresh departures are taken. Finality can never be expected. It only remains for us to watch our neighbours in order to profit by their experience, and equally watch ourselves to guard against inactivity. "S'arrêter c'est de rétrograder."

THE ORGANISATION OF A GARRISON COMPANY.

BY

MAJOR P. SALTMARSHE, R.A.

Organisation of a Garrison Battery compared with that of a Field or Horse.

In a Horse or Field Battery, divided as it is into two or three divisions or sections of two sub-divisions each, the establishment of such units with their officers, N.-C. officers, gunners, drivers, and artificers, is clearly laid down, and as far as possible the subaltern officers and their Nos. 1 have charge of the same men both in barracks and on parade. The advantages of such a system it is needless to point out.

Except sometimes in a spasmodic sort of fashion, no such system appears to have prevailed in the Garrison Artillery, and I have never seen any continued attempt to keep men under the same officers and N.-C. officers at gun drill, on other parades, and in the barrack-rooms; that this has been the case is due no doubt partly to the ever varying detachments that have to be found, but chiefly, I think, to the fact that up to the date of the re-organisation, but one subaltern, as a rule, was continuously present with head-quarters, one being on detachment, and in the event of there being three with the battery, another going through a course.

With the present establishment of most Garrison Companies, however, a Commanding Officer may hope under favourable circumstances to have four at head-quarters, and under the most unfavourable to have at least two.

The organisation I suggest will meet either case.

Divisions or Sections and Sub-Divisions.

I propose dividing the company into four sections or divisions each under a subaltern officer, such being numbered A B C and D Divisions; each division to contain either two or three sub-divisions according to the nature and grouping of the guns of the fort or battery the company is told off permanently to man, these sub-divisions being numbered from 1 to 8, or from 1 to 12.

Establishment of a Company.

Taking the establishment of a company to be that laid down in R.O. 76 of 28th July, 1891, for the Southern District, plus the gun-layers which by a subsequent order are now borne on the strength of the company we have a total of

Major	1
Captains...	2
Subalterns	5
Sergeant-Major	1
Quarter-Master Sergeant	1
Pay-Sergeant	1
Sergeants	9
Corporals	10
Bombardiers	10
Acting-Bombardiers	10
Gun-Layers	36
Gunners[1]	180
Trumpeters	4
Total all ranks	270

[1] In R.O. 76 of 1891 the Acting-Bombardiers are included among the 190 gunners.

Proposed Distribution.

I should distribute these details as per following table :—

Ranks.	A Div.		B Div.		C Div.		D Div.		Total.
	No. 1 Sub.	No. 2 Sub.	No. 3 Sub.	No. 4 Sub.	No. 5 Sub.	No. 6 Sub.	No. 7 Sub.	No. 8 Sub.	
Major	1	—	—	—	—	—	—	—	1
Captains	—	—	1	—	—	—	1	—	2
Lieutenants	—	1	—	1	1	1	—	1	5
Company Sergt.-Major	1	—	—	—	—	—	—	—	1
" Q.-M. Sergeant	—	—	—	—	—	—	—	1	1
Pay-Sergeant	—	—	—	1	—	—	—	—	1
Sergeants	2	1	1	1	1	1	1	1	9
Corporals	1	1	2	1	1	2	1	1	10
Bombardiers	1	2	1	1	1	1	1	2	10
Acting-Bombardiers ...	1	1	1	1	2	1	2	1	10
Gunners	28	27	27	26	27	26	28	27	216 (including gun-layers).
Trumpeters	—	1	—	1	—	1	—	1	4
Total all ranks	35	34	33	33	33	33	34	35	270

We have now to consider how far this distribution is adaptable.

(1.) To parades in the barrack-square.
(2.) To manning a fort.
(3.) To interior economy, barrack accommodation, &c.

Parades—Company drill, Battalion drill, Sword drill, &c.

With regard to (1) there is little or no difficulty ; when a company is struck off duty for its annual course, inspections, &c., there should be, after making every allowance for men in hospital, in prison, under establishment, permanently employed as clerks in regimental or district offices, servants to officers on the regimental or district staff, on command, &c., from 45 to 50 men on parade in each division.

Company drill.

This is a sufficient number to form a company (I use the word in the infantry sense), and the men forming each of these companies should be always exercised at company, sword, carbine, physical drill, &c., by or under the superintendence of its own divisional officers.

Battalion drill.

Four of these divisions will then form a convenient command for the Major when he comes to march past the whole company and put them through battalion drill.

N.B.—The word company is a little awkward at battalion drill, the battery as a whole being now a company, and its divisions on this occasion being also companies, but I do not see how this is to be avoided if we are to follow the infantry nomenclature.

On ordinary occasions, *i.e.*, when the company is not going through its annual course only two infantry companies could probably be found. A and B Divisions would then furnish one, C and D the other.

Captains' duties.

I have as yet said nothing about the Captains; what with the Staff College Long Course, other courses of all descriptions, acting staff appointments, etc., I do not think more than one can ever be counted on. I should make him second in command as in the mounted branches, on parade he would perform the duties of Adjutant, in manning a fort those of Sub-Commander.

Of course, if there are two they would perform the duties laid down in R.O. 76 of 1891.

Manning a Fort.

(2.) As regards manning a fort the matter is far more complicated. In one station a company may be told off to a casemated fort armed with 47-ton B.L. or 12·5″ R.M.L. guns, and equipped with machinery of the newest pattern, in another to an open battery armed with nothing heavier than 6″ guns.

The organisation, I am endeavouring to describe, would as far as the divisions go, I think, be adaptable to either, but not so, of course, with regard to sub-divisions as with lighter guns a greater number could naturally be manned.

I propose in these notes to apply it to one case only, viz., that of a fort or battery armed with the heaviest type of guns in general use for land service, viz., 47-ton B.L. guns and 12·5″, or 10″ R.ML. guns.

I think it is conceded that two guns of this description, especially if mounted in a casemated fort like Hurst Castle and the Spit Forts, or in an open battery with huge traverses between them, like Cliff End Battery near the Needles, are all that one officer can efficiently command.

One division of the company would, therefore, on entering such a fort or battery become a group, each sub-division working one gun.

The Divisional Officer becomes the Group Officer, the No. 1 of each sub-division the Gun-Captain.

We will now consider the details approximately necessary for manning eight of these guns, they are as follows :—

Fort details for 8 heavy guns.

FORT DETAILS.

Fort Commander, 1 Major.

Sub-Commanders, 1 or 2 Captains.

Fort Commander's Staff, 1 N.-C.O., 2 gunners, 2 trumpeters.

Sub-Commander's Staff, 1 gunner, 1 trumpeter.

Range Transmitters (if using D.R.F.) 2 N.-C.O.'s, 2 gunners.

Magazine and Shell Store Nos., 2 N.-C.O.'s, 12 gunners.

Ammunition Supply Nos., at lifts or otherwise, 1 N.-C.O. and 16 gunners.

Operators at tubes and telephones, 9 gunners.

Signallers, 2 N.-C.O.'s and 4 gunners. (These would not all be required but 6 signallers is laid down for a company).

Total Fort Details—1 Major, 1 or 2 Captains, 8 N.-C. officers, 46 gunners and 3 trumpeters.

Group details.

Group Details.

Group Officers, 4 Lieutenants.
Group Officer's Orderlies, 4 gunners.
Dial Readers, 8 gunners (in many cases only 4 would be required).
Gun Detachments, including layers, 16 N.-C.O.'s, and 88 gunners.
Total Group Details—4 Lieutenants, 16 N.-C. officers, and 100 gunners.

Total detail.

Grand Total—1 Major, 1 or 2 Captains, 4 Lieutenants, 24 N.-C. officers, and 146 gunners.

N.B.—The Sergeant-Major, Quarter-Master Sergeant, Pay Sergeant, 1 trumpeter, 15 N.-C. officers and 70 gunners not accounted for, as to these see remarks on page 509.

District Staff.

District Staff (Attached).

Postion-finders or Depression Range-finders, say 4 N.-C. officers, and 8 gunners.
Magazine Gunners, 1 gunner.
Lamp men, 2 gunners.

Distribution by divisions.

These details I should distribute among divisions and sub-divisions somewhat as follows :—

A Division.

No. 1 Sub-Division.

N.-C.O's.
- 1 sergeant, gun-captain and No. 1.
- 1 sergeant, spare.
- 1 corporal, spare.
- 1 bombardier, gun detachment.
- 1 acting bombardier, signallers.

Gunners
- Group Details
  - 11 gunners, gun detachment, including layers.
  - 1 Group Officer's orderly.
  - 1 dial reader.
- Fort Details
  - 2 lift or ammunition supply Nos.
  - 2 magazine Nos.
  - 1 telephone operator, or tube No.
  - 2 signallers.

Total—5 N.-C. officers and 20 gunners.
1 N.-C. officer and 1 gunner P.F. or D.R.F. district staff attached.

No. 2 Sub-Division.

N.-C.O.'s
- 1 sergeant No. 1 and gun-captain.
- 1 corporal, spare.
- 1 bombardier, Fort Commander's staff.
- 1 bombardier, spare.
- 1 acting bombardier, gun detachment.

Gunners
- Group Details
  - 11 gunners, gun detachment.
  - 1 dial reader.
- Fort Details
  - 2 lift or ammunition supply Nos.
  - 1 magazine No.
  - 2 telephone operators or tube Nos.
  - 2 orderlies, Fort Commander's staff.
  - 1 trumpeter.

Total—5 N.-C. officers, 19 gunners, 1 trumpeter.

1 gunner, P.F. or D.R.F.
1 gunner, magazine gunner
} District staff attached.

I have shown in the following tabular form the distribution of the whole company in the same way.

Rank.	Distribution by Divisions. — Station in Manning the Fort.	A Div. forming A Group.		B Div. forming B Group.		C Div. forming C Group.		D Div. forming D Group.		Total.	
		No. 1 Sub-Div. A/1 Group.	No. 2 Sub-Div. A/2 Group.	No. 3 Sub-Div. B/1 Group.	No. 4 Sub-Div. B/2 Group.	No. 5 Sub-Div. C/1 Group.	No. 6 Sub-Div. C/2 Group.	No. 7 Sub-Div. D/1 Group.	No. 8 Sub-Div. D/2 Group.		
Staff Sergeants.	Sergeant-Major	1	—	—	—	—	—	—	—	1	3
	Quarter-Master Sergeant	—	—	—	—	—	—	—	1	1	
	Pay Sergeant	—	—	—	1	—	—	—	—	1	
Sergts.	No.'s 1 and Gun-Captains	1	1	1	1	1	1	1	1	8	9
	Spare	1	—	—	—	—	—	—	—	1	
Corporals.	In charge of magazine details	—	—	1	—	1	—	—	—	2	10
	Signaller	—	—	—	—	—	—	—	1	1	
	[1] Range transmitters D.R.F.	—	—	—	—	—	1	—	—	1	
	Spare	1	1	1	1	—	1	1	—	6	
Bombardiers.	Fort Commander's staff	—	1	—	—	—	—	—	—	1	10
	[1] Range transmitters	—	—	1	—	—	—	—	—	1	
	In charge ammunition supply	—	—	—	—	—	—	1	—	1	
	[2] In gun detachments	1	—	—	—	—	—	—	1	2	
	Spare	—	1	—	1	1	1	—	1	5	
Acting Bombrs.	Signallers	1	—	—	—	—	—	—	—	1	10
	In gun detachments	—	1	1	1	1	1	1	—	6	
	Spare	—	—	—	—	1	—	1	1	3	
	Total N.-C. officers	6	5	5	5	5	5	5	6	42	

[1] A N.-C.O. is required for this duty, as the putting up the electrical connection is part of it; in a large fort two are used.

[2] I have allotted throughout two N.-C. officers to each gun detachment, which, I think, is desirable. The gun-layer is often an Acting Bombardier.

TABLE.—*Continued.*

Rank.	Distribution by Divisions. — Station in Manning the Fort.	A Div. forming A Group.		B Div. forming B Group.		C Div. forming C Group.		D Div. forming D Group.		Total.	
		No. 1 Sub-Div. A/1 Group.	No. 2 Sub-Div. A/2 Group.	No. 3 Sub-Div. B/1 Group.	No. 4 Sub-Div. B/2 Group.	No. 5 Sub-Div. C/1 Group.	No. 6 Sub-Div. C/2 Group.	No. 7 Sub-Div. D/1 Group.	No. 8 Sub-Div. D/2 Group.		
Gunners.	Trumpeter	—	1	—	1	—	—	—	—		
	Fort Details. Signallers	2	—	—	—	—	—	—	2	4	
	Fort Details. Lift or ammunition supply Nos.	2	2	2	2	2	2	2	2	16	
	Fort Details. Magazine Nos.	2	1	2	1	2	1	2	1	12	
	Fort Details. Tube or Telephone Nos. ...	1	2	1	1	1	1	1	1	9	46
	Fort Details. Orderlies, Fort Commander	—	2	—	—	—	—	—	—	2	
	Fort Details. Orderlies, Sub-Commander...	—	—	—	—	—	—	1	—	1	
	Fort Details. Range transmitters	—	—	1	—	—	1	—	—	2	
	Group Details. Group Officer's orderlies ...	1	—	—	1	1	—	1	—	4	
	Group Details. Dial readers	1	1	1	1	1	1	1	1	8	
	Group Details. [1] Gun detachments	11	11	11	11	11	11	11	11	88	170
	Group Details. Spare	8	8	9	9	9	9	9	9	70	
	Total Gunners	28	27	27	26	27	26	28	27		216
	Fort Commander's staff	—	1	—	1	—	—	—	—	2	
	Sub-Commander's staff	—	—	—	—	—	—	—	1	1	4
	Spare	—	—	—	—	—	1	—	—	1	
	Grand total N.-C. officers and men	34	33	32	32	32	32	33	34		262 [2]
	DISTRICT STAFF ATTACHED.										
Gunners.	N.-C. officers—P.F. or D.R.F. ...	1	—	1	—	1	—	1	—	4	4
	P.F. or D.R.F....	1	1	1	1	1	1	1	1	8	
	Magazine gunners	—	1	—	—	—	—	—	—	1	15
	Lamp men	—	—	—	—	—	—	2	—	2	

[1] Including layers when the layer is not an N.-C.O.

[2] Adding the eight officers this gives a total of 270 all ranks. It will be found that the numbers in each rank in each division and sub-division correspond with those on the table on page 504.

In the above distribution, following the example of the Horse and Field Artillery, I have made each division or group as complete in itself as possible with its gun detachments, range-finders, dial readers, lift men, &c.,; purely fort details as Fort Commander's staff, I have kept as much as possible in the same sub-division.

Allowance for Non-effectives.

It will probably be queried, why are so many N.-C. officers and gunners accounted for as "spare" instead of detachments for more guns being provided? My reply is, I have endeavoured to suggest *not* a purely paper organisation, but one which can be carried out under ordinary circumstances.

Last year when every endeavour was made to send my battery to Golden Hill for its annual course as strong as possible, but 100 all told out of an establishment of 150 could be got together, and we had even less the year before at the annual training at Portsmouth.

In the above table it will be noticed that 15 N.-C. officers (exclusive of Sergeant-Major, Quarter-Master Sergeant, and Pay Sergeant) and 70 gunners are put down as spare, and this allowance will not be found too great for casuals, vacancies, men on courses, unrelievable employed men, such as clerks in regimental and district offices, servants to regimental and district staff, &c., besides men necessarily employed in the company as cooks, &c.

An average of 12 N.-C. officers is generally unavailable for parade even when the company is going through its annual course.

I always think it a matter of regret that, in arranging manning tables for our coast defences, the *paper* establishment *not* the average number of effectives is taken as a basis of calculation.

For a short parade on the barrack-square a greater number of men can usually be got together than for manning a fort some distance off, which, especially if practice is carried out, is often a day's work.

Of course if the company was up to its full establishment and at a station where it had to find but few employments, a fifth division or group might be formed, and, as I have stated above, if the guns of the fort it had to man were of a lighter nature a division or group might consist of three sub-divisions instead of two.

Barrack accommodation.

(3.) As regards barrack accommodation, messing, &c.:

To carry out any such system as this as far as interior economy goes, the number of barrack rooms available should, ideally speaking, correspond with or be double of the number of sub-divisions. In the case I am describing 8 very large rooms or 16 small ones would be the number. This however could be rarely arranged.

My own company has at present 14 rooms; putting the attached men of which there are a considerable number, in 2 rooms, I allot 3 to each division of the company, each sub-division with its No. 1 and effectives being as far as possible in one room, the employed men and non-effectives of both sub-divisions being in the other.

The No. 1 of the sub-division is responsible for the kits, equipment, &c., of all men of his sub-division at head-quarters whether they are in his room or not.

The duties of subaltern officers with regard to their divisions to be the same, as far as possible, as in the mounted branches except as

regards the care of the guns and ammunition, over which the Master-Gunner has charge, the latter being immediately responsible to the officer in charge of the fort as heretofore.

Duties of Subaltern Officers.

The subaltern officers to keep squad-books of the men in their divisions, specifying the gun squads, gun-layers, specialists, &c., and a list of men to be kept in each barrack-room showing each man's place on the fort, what group he belongs to, and his number in the gun detachment.

5th Subaltern.

The fifth subaltern if there is one to look after the out detachments, if there is not, one of the others to be told off monthly to perform this duty in addition to the charge of his own division.

Difficulties in carrying out above.

In carrying out any such system of organisation as the above, I am fully aware there are many difficulties to be contended with.

The following I regard as the two principal, viz.:

Out Detachments.

(*a.*) The many and ever changing out detachments that have to be found.

If a company one week finds a detachment 20 strong, if the next week this has to be increased owing to armament work or other causes to 40, and the following week two other small detachments say have to be found, it stands to reason it is very difficult to keep the divisions or sub-divisions together.

Ideally speaking one ought to send a division on detachment, or a sub-division, keeping the remainder together as would be done in the mounted branches, but in furnishing isolated detachments in the Garrison Artillery especially for sea forts, the best men, and very often men with some technical knowledge, and in all cases volunteers if possible should be sent; take for instance one of the Spit forts, the detachment here often consists of men assisting the ordnance artificers, men learning the hydraulic lifts, machinery gunners, recruits learning gun-drill, &c., it would be impossible to have all these men in one division, as when manning a fort they must necessarily be split up among all four.

What I propose is this, to keep always the cadres of each sub-division at head-quarters, and when furnishing detachments, to send an equal number, as far as possible, of men from each, the Divisional Officers and Nos. 1 selecting such men according to their fitness for the duties required of them, always giving preference when it can be done to volunteers.

When such detachments are called in to head-quarters, for annual training, inspections &c., the men forming the same will rejoin their own sub-divisions, and will find their place ready for them at any time in their own barrack-rooms.

Messing.

The men can mess either by sub-divisions or divisions according to the numbers at head-quarters, and the size of the barrack-rooms.

(*b.*) The second great difficulty to be contended with is the constant transfer of the N.-C. officers to the Auxiliary forces, Depôt, District Staff, &c., or their temporary absence from the company for courses.

This cannot, I suppose, be helped, all that can be done to obviate the inconvenience arising from it, is to split up among the different

sub-divisions as equally as possible the N.-C. officers who are likely to leave the company in the near future.

Concluding remarks.

I have always felt strongly, that in the Garrison Artillery the work of the subaltern officers is not sufficiently defined, that they have no particular charge and are not, as a rule, properly identified with any particular N.-C. officers and men.

I believe the fact that each has a special charge is one of the reasons that makes the Field Artillery more popular among the junior officers of the Regiment, and I do think that if we could permanently adopt some such system of organisation in the Garrison branch, the interest of the subaltern officers in their company work would be greatly increased, and there would be less tendency on the part of the Major and Sergt.-Major to work the whole show.

ACHIEVEMENTS OF FIELD ARTILLERY.

BY

MAJOR E. S. MAY, R.A.

Chapter I.—PART II.

The Era of Napoleon.

With the advent of the Nineteenth Century the position of artillery as an arm became immensely improved, and the divisional system of organization introduced by the young French Republic was to a large degree responsible for the change. Mobility and flexibility were the characteristic of their armies, and their guns having to keep pace with the other arms, increased and successful efforts were made to render them equal to the new demands. Not only this, but the necessities of the Republic obliged it to adopt a different method of conducting operations to what was in vogue with States better endowed in all the paraphernalia and equipment required by the old methodical system of fighting. Armies were split up into units, each complete in itself, able to move independently, and, above all, able to forage for themselves. The pedantic and formal methods which looked for supply from magazines and depôts, and regarded the safety of communications as a first consideration, were gradually swept away, and with them many of the old traditions and prejudices which had crystalized round them. Battalion guns disappeared with the rest, and artillery assumed its proper place, looking to a chief of its own for direction, and forming an integral portion of an army on an equal footing with the other arms. As we have hinted already, even Frederick had viewed artillery, at the commencement of his career at any rate, with more suspicion than regard, and probably to the end of his life looked upon the arm rather as a necessary evil than a gift of providence.

In the early days of Napoleon, although as an artillery officer he naturally ever appreciated its powers, economical considerations equipped him but sparsely with artillery, and probably hampered its action in his hands. Artillerymen cannot be trained in a hurry, nor are losses of guns and horses easily replaced. As, however, he grew in power, until eventually the whole resources of the State were at his disposal, such considerations no longer restrained the full exercise of his judgement, and the General who set so high a store on fire effect, was not slow to develop the arm which offered the richest result in that respect.

To quote his own words—"*C'est l'artillerie de ma garde qui decide la plupart des batailles, parce que l'ayant tonjours sous la main, Je puis la*

porter partout où il est nécessaire." It must be noted, however, that these words were not intended to imply that because a mass of guns were held in hand they remained idle until the supreme moment arrived. On the contrary, at Wagram we find them, as we shall see later on, actively engaged during the whole contest, and filling a breech in his own line as well as making one in that of his foes. The heresy of a reserve of artillery was never encouraged by Napoleon, although he took care to have a powerful force ever close to him "*sous la main.*"

The bringing up of the artillery of the guard, a force which soon became invested with special terror in the eyes of his foes, to strike the final blow is indeed a marked feature in his later battles, but it was not till after the tactics of the arm had been carefully revised at the great camp of Boulogne in 1805, that we find any striking examples of its employment in that concentrated fashion which is essential to decisive results. At Marengo, however, that fortunate victory which made him first consul, he owed much to the unexpected appearance on the scene of twelve pieces of Boudet's division, and the French army was indebted for its salvation not a little to their support.

Taubert says of this battle—"The twelve guns of Boudet's division, which had only just arrived, checked the victorious career of the Austrians by their unexpected and effective fire; they became, too, the supporting point of all the manœuvres which turned the fate of the action. It was the last barrier of the already beaten French army; by it the French Commander-in-Chief supported his discomfited and exhausted divisions; and from it and the impetuous attack of fresh forces, resulted the change which snatched the blood-bought victory from the Austrians."[1]

Napoleon, however, had yet to learn the full power of a mass of guns in the bitter school of experience, and it is from his most stubborn foes that the first example of the effect of a great mass of guns may be quoted.

It is remarkable that the Russian army has ever been especially strong in artillery, and has always attached great importance to the arm. Just as Frederick felt the weight of Russian batteries at Kunersdorf, so did the next great military genius who arose after him experience their power at Eylau. The feat of the great Russian battery of 40 guns, which at this bloody battle destroyed the corps of Augereau, is justly celebrated in the annals of war, and if we do not here dwell at any great length upon it, it is not because we would depreciate in the least the deeds of the Russian gunners, but rather because the peculiar conditions under which their triumph was effected take it a little out of the realm of legitimately earned success, and stamp it rather with the character of a brilliant coup rendered possible, or at least greatly assisted, by fortuitous and exceptional circumstances.

Napoleon, finding the Russians standing firm at Preussisch Eylau on the 7th February, 1807, determined to turn their left. The better to conceal his intentions he commenced a violent attack on their right and centre soon after daylight. The left, under Augereau, advanced in heavy columns towards Schloditten, whilst Soult's corps preceded by

[1] The use of Field Artillery on service.

150 pieces of artillery pushed on against the centre. The Russians had distributed a very powerful force of artillery along their front, and Augereau's corps soon found itself opposite to a mass of about 70 guns. These ploughed his crowded columns with most deadly effect, and they recoiled under the fire to the left in order to gain what protection they might from the shelter of a detached house which stood before them. At the same moment a dense storm of snow came on, and soon neither side could see their opponents. Moreover, the melting snow so wetted the muskets and ammunition that they became almost useless, and the infantry on both sides were incapable of fire action. In the midst of the confusion thus engendered, and still much shaken by the unremitting artillery fire, Augereau's column found itself assailed in the obscurity by the Russian reserve cavalry on one side and by their right wing on the other. Prevented by the cavalry from deploying, unable to use their weapons, and blinded by the snow, the French columns became almost helpless, and were literally torn to pieces by the battery before them. The whole of Augereau's corps which went into action, more than 16,000 strong was destroyed, save a wretched remnant of 1500 men that managed to crawl back to the French position. The remainder were all either taken or left on the field, and Augereau himself, with his two Generals of division, Desgardens and Heudelet, was desperately wounded. This immense effect has caused the feat of the Russian guns to be justly celebrated, and as an example of what, under favourable conditions, a mass of guns can accomplish, it certainly deserves to be remembered. Napoleon himself is said to have been profoundly impressed by what he saw, and the terrible loss he sustained forcibly brought home to him the tremendous power a concentrated artillery can develop. The chapter of accidents, however, which prevented the French infantry from availing themselves of their most valuable weapon, and the manner in which the snowstorm favoured the guns seems to detract somewhat from the feat they accomplished, and artillery has scored triumphs where the field was fair, and neither side was favoured by fortune upon which we would rather build its reputation. This instance, therefore, of its power, although a feat of arms of which the arm may be justly proud, is but lightly touched upon here, and we pass on to another which soon followed it, which perhaps astonished the great Emperor even more, and which is more proudly remembered by gunners, because on that occasion artillery, with noble unselfishness, entered the lists with all the odds against it, and dared destruction to come to the rescue of its hard pressed comrades of the other arms.

Senarmont's "*bouquet de feu*" at Friedland was achieved with an audacity so brilliant as to approach temerity, and had he not snatched success from the struggle, the feat would no doubt have been termed impossible. Let us see how his valour was justified:—

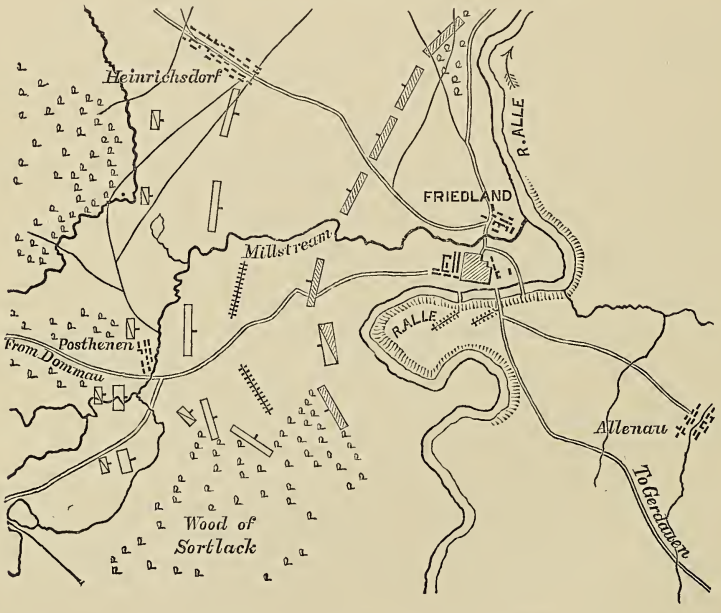
General Senarmont, an enthusiastic artilleryman, had been appointed on the 21st of February, 1807, immediately, therefore, after the battle we have just been speaking of, to the command of the artillery of the 1st Corps of Napoleon's army. This corps was under the command of Bernadotte, Prince of Ponte Corvo, and consisted of three divisions under Generals Dupont, Lapisse, and Villatte. The guns placed under

his orders numbered 38 pieces in all: that is to say, 4 12-prs., 22 6-prs., 4 4-prs., and 8 7-pr. howitzers. Of these, 12 were allotted to Dupont's division, and 10 to each of the other two divisions. Six pieces were held in hand to form an artillery reserve for the corps.

Both sides were so exhausted by the bloody and indecisive battle of Eylau, that neither seemed in any hurry to recommence hostilities, and for more than three months not a blow was struck. On the 5th of June, however, a combat took place at Spandau, in which Bernadotte was wounded, and the command of the 1st Corps devolved on Victor in consequence.

On the 14th of June the Russian General, Beningsen, thought he saw an opportunity to crush the corps of Lannes, which appeared temptingly unsupported in front of him, ere Napoleon could come to its assistance, and, accordingly, early that morning he crossed the Alle at Friedland to crush an opponent who seemed at his mercy. The intended victim skilfully kept his adversary at bay however, and his force being gradually reinforced from the rear, the resistance proved far more serious than the Russian General had anticipated. More and more troops were hurried across the river as the combat deepened, and the golden moments were slipping by, and soon the Russian General found himself committed to a general action, fighting with his back to a broad river against an adversary every hour growing stronger. Napoleon arrived on the scene about 1 o'clock from Dommau, and determined to attack. It was the anniversary of Marengo, and

BATTLE OF FRIEDLAND; 14th June, 1807.



the day was therefore peculiarly auspicious. He viewed his enemy defiling over the bridges on the narrow plain beneath him with an

exultating confidence. They were soon drawn up upon the cord of the arc formed by the river here, while a powerful artillery covered their retreat over the bridges from the opposite bank of the river. Lannes and Mortier, who had come to his support, had fallen back to the high ground between Posthenen and Heinrichsdorf, and in the woods behind Napoleon assembled his forces as they successively arrived. By 4 o'clock about 70,000 infantry and 10,000 horse were assembled, according to Alison, while Beningsen had no more than 38,000 infantry, and 8000 cavalry on the left bank of the Alle to oppose them with.[1] His dreams of destroying Lannes had long since vanished, and he realised with dismay that now he could only hope to hold his ground till nightfall, when he might perhaps slip away from his powerful opponent and gain the right bank of the Alle once more.

But Napoleon had marked the importance of Friedland and was not going to let him escape.

At 5 o'clock a salvo of artillery gave the signal for the French to assume the offensive, and Ney's corps, consisting of the divisions of Bipon and Marchand, emerged from behind Posthenen, and swiftly moved to the attack between the mill stream and the river. Their impetuous leader hurried them on in two columns to outflank the Russian left, and at first he carried all before him, but the further he pressed forward the more his right column, formed from Marchand's division, became exposed to a raking fire from the powerful Russian batteries on the opposite bank of the Alle. His left column, too, was soon heavily assailed, while the cramped nature of the ground and the small space available for manœuvre further hampered his movements. Secure from attack, owing to their unique position, the Russian gunners across the river laid with cool precision, and every shot told. Soon Ney's columns were seen to hesitate and waver, and Bragation, who commanded the Russian left, promptly took advantage of their confusion, the Russian Guard charged the confused columns of their opponents resolutely, and in a few minutes not only had the French lost all the ground they had just gained, but the safety of their right wing appeared in jeopardy.

Meanwhile, however, Victor's corps which had been held in reserve was moved forward, and Dupont's division hurried on to retrieve the disaster. General Senarmont accompanied the battery belonging to this division into action, but found the Russian fire overpoweringly strong, and the French infantry could make no headway against the tide of Russian success. The moment was a critical one, and some great effort must be made if the fortunes of the day were to be changed. Senarmont saw a great opportunity for his arm, and having obtained the consent of Victor to utilise all the guns of his corps as he pleased, he swiftly put his project into execution.

In spite of the murmurs and remonstrances of the different Generals, who naturally did not wish to be deprived of all their artillery at such a moment, he formed the Divisional Artillery of the corps into two great batteries of fifteen guns each, with the remainder in reserve, and placed one on the right in front of the wood of Sortlack, and the other

[1] Taubert, however, places the Russian strength as high as 60,000 on the left bank of the river.

on the left in advance of Posthenen, behind which he posted the reserve. Thus, the enemy's guns and columns as they pressed forward were brought under a concentrated and crossing fire, which almost immediately began to tell. As the Russians fell back before the advance of the French reinforcements and this well directed fire, the two great batteries moved forward, and soon from the converging nature of their movements they approached close to one another, and were formed together into one great battery, which Senarmont could himself direct with more facility, than when he had to move, as he did, from one battery to another.

The guns had opened at 400 metres, but after five or six salvoes they were led with rare audacity within half that distance of the enemy. As the guns pushed on beyond the French line all who saw them were absolutely astounded, and it is said that Napoleon himself was at first so greatly taken aback that he cried in horror, "*Mon Dieu! le Géneral Senarmont déserte!*"

Then he sent his aide-de-camp, Mouton, to call the eager General back from his rash enterprise, and to ask him what he meant by thus pushing forward unsupported. Full of his project, Senarmont would listen to no one however. "*Laissez moi faire avec mes canonniers,*" he shouted, "*Je réponds de tout.*" Little pleased with the message he had to bear, Mouton returned to the Emperor. But already the keen eye of the latter had seen that the guns were producing an effect, and the success of his lieutenant had atoned already for his independence. Mouton found him quite mollified and a pleased smile played round his mouth as he received him. He shrugged his shoulders and said laughingly, "These gunners are unruly fellows, let them do as they will."

The well served fire of this great mass of guns had in fact relieved the pressure on the French right at once, and drew the shells of the Russian batteries from off the infantry. Gathering way once more under their support, Dupont's division returned to the charge, and soon Ney was assailing the town of Friedland, and the Russian line of retreat across the bridges was dangerously threatened. As the French pushed on, the press and confusion in the town became so obvious that their divisions were hurried forward to the assault, the streets were forced, and many buildings, and the bridges were soon in flames. The defeat of the Russian left meanwhile had dangerously exposed their centre, and Beningsen saw with dismay that his communication with the right bank was compromised. Indeed, the French pressing on in superior numbers on the centre and left quickly left the issue of the battle little doubtful. A stream of fugitives was soon setting towards the bridges, and the Russian cavalry gallantly dashed forward to cover the retreat.

Meanwhile Senarmont's audacity grew greater with success. With a firm confidence in the invincibility of his splendid batteries he hurried them to the front once more, and again took them nearer still, so as to complete the ruin of the Russians, and assail their retreating columns in flank. With a true instinct he disregarded the artillery fire which was now poured upon him, and concentrated all the efforts of his guns

towards consummating the ruin of the troops he saw before him trying to escape. The enemy's cavalry, noting his exposed position, swooped down upon his left flank. In a moment he has swung his guns round to meet them; and two salvoes of grape are enough to shatter their effort, and the squadrons mown down by canister melt away. His terrible fire sweeps once more the road to Friedland, the Russian retreat becomes a total rout, and the fate of their army is sealed. The Russian loss has been variously estimated, as is usually the case where Napoleon's battles are concerned. Some French accounts say they lost as many as 80 guns, while, according to others, 17 only were captured. It is certain that the Russians fought with magnificent bravery, and that their resolution staved off what might have been a far more serious disaster. They left some 17,000 killed and wounded on the field, and 5000 prisoners fell into their enemy's hands, who on their part lost 8000 men and two eagles.[1]

But Friedland, whatever may have been the number of the trophies, was a most decisive victory as regards the consequences it entailed, and the combination against Napoleon was effectually for the time destroyed by it. Senarmont's brilliant action contributed in no small measure to the result of the day, and he received much credit for it. Never before had artillery played so independent a part, and it may be said that neither before nor since has the arm been handled with greater vigour and skill. Whether in a modern battle calculated courage, such as has been described, could ever again hope to achieve so much seems impossible, but at least the promptitude with which an opportunity was seized and acted upon deserves our admiration and attention.

A quick eye and swift decision will never be at a discount, however, and even in the most scientifically conducted battle of our own day, it is possible that the surges of the fight may leave an opening in which an artillery general may again recognise his chance, and know how to turn it to account.

Senarmont's report gives his losses as follows:—

> 1 officer and 10 gunners killed; 3 officers and 42 men wounded. The number of rounds fired was 2516, of which 368 were grape. 53 horses were killed.

Two years later Napoleon was again at war with Austria, and in the campaign of Eckmühl had given the world another magnificent example of what his genius could effect. Vienna fell an easy prey to him, and shortly after its capture he began to cast about for a means of getting at the Archduke Charles, who had made his escape to the northern bank of the Danube, and whose army formed a standing menace and nucleus of resistance to the French power.

On the 21st and 22nd of May, 1809, Napoleon had endeavoured to force his way across a broad river in the presence of a powerful enemy, relying on one frail bridge only. It says much for the skill and

[1] In a letter to his brother, dated "Tilsit, June 26th, 1807," which is given by Captain de l'Ain in his account of this battle, Senarmont says—"The position of the enemy showed 4000 dead on this spot alone" (that opposite to his battery). . . . . "I lost the chief of my staff, Colonel Formo, killed by a ball at the end of the action; I have had 3 officers and 52 gunners placed *hors de combat*, and a charming horse wounded under me; I fear I shall not be able to save him."

bravery of the French troops that they so nearly achieved success as they did, and that the breaking of their bridge alone held them off from victory. As it was, however, they were driven back into the Lobau, and narrowly escaped total destruction. But Napoleon showed himself greater in disaster and more fertile in resource than even he was in the flush of conquest. He collected a powerful army in the strong entrenched camp which the island formed, and at the commencement of July was ready to make another effort.

In order to deceive his antagonist, for weeks past he had been preparing batteries (opposite the place marked A. on the plan), where he

BATTLE OF WAGRAM; 5th and 6th July, 1809.

A Point of Napoleon's first passage from the Lobau previous to battle of Aspern.
B Point of passage previous to battle of Wagram.
C Point of passage of main channel of Danube.

had originally crossed, and the spoils of the Arsenal of Vienna placed a large number of powerful guns at his disposal, with which he hastened to arm his works. More than 100 heavy pieces, therefore, bristled along the northern shore of the island. It is necessary to note the existence and position of these guns, for they will play an important part in the great battle which we are going to deal with.

On the night of the 4th of July a furious cannonade from these batteries entirely deceived his adversaries, while the whole French army slipped across from the eastern side of the island in front of Enzersdorf, and on the morning of the 5th the Austrians found their left completely turned, all their elaborate preparations between Aspern and Essling rendered useless, and their enemy in superior numbers across the Danube and preparing to sweep round their left flank. They fell slowly back to the Wagram plateau, and the evening found them drawn on a vast arc, stretching from Neusiedel, by Wagram and Saüring, to Hagenbrunn. The Emperor that evening tried to force their line between Wagram and Baumersdorf, but his effort was repulsed. Early next morning he had intended to renew the attack,

but the Archduke was beforehand with him, and assailed his right at Glinzendorf ere he could move.

The battle which now ensued is one in which the incidents succeed one another with bewildering rapidity, and fortune appears to favour both sides alternately throughout the day. While the French were winning at one end of their long line they were being beaten at another, and when victory seemed more than once within grasp of the Austrians, their chance appeared suddenly to melt away. As we regard the combat from the artillerist's point of view alone, we can only take a very brief survey of its incidents, but one or two features stand out distinctly and must not be passed over.

In the first place this is one of the greatest fights, measured by the numbers engaged, which has ever taken place. The French force has been differently stated by various authors, but was probably not less than 150,000 infantry, 30,000 cavalry, and 600 field guns. The Austrians were considerably weaker in number, and mustered perhaps 140,000 men, but were supported by a very powerful artillery, too. Then, again, on this day an unexampled use was made of guns, and Marbot says in his Memoirs that at the commencement of the fight on the 6th, 1200 pieces were in action on both sides, and that such a tremendous artillery combat had never before been witnessed. Finally, the fact that these vast hosts were locked in a death struggle within sight of the towers and steeples of Vienna, from which the straining eyes of the inhabitants watched with painful interest the lines of smoke, gives a dramatic air to the combat, such as none other save perhaps Waterloo possesses.

The Austrian attack on his right took Napoleon, who was near Raasdorf with the guard and reserve cavalry, by surprise, but he hurried up his guard and a strong force of artillery to support Davout, whose corps was on the threatened flank, and the Austrians were brought to a stand-still principally, Marbot says, by the fire of these guns. Hardly, however, was the danger over on his right ere Napoleon's attention was rudely drawn to his centre and left.

He had intended to commence the fight on the 6th by assailing the Austrian centre and left. Massena had been brought, therefore, from Aspern towards Aderklaa, and the corps of Oudinot, Eugene, Bernadotte, and Marmont were all drawn up between Davout, on the extreme right, and that village. Thus the French left had been unduly weakened.

While the Austrian left were pressing forward at Glinzendorf, Bellegarde in their centre also advanced to Aderklaa, and pushed Bernadotte roughly out of the village. Klenau and Kollowrath, on the Austrian right, likewise took the offensive towards Breitenlee and Aspern, and were soon threatening the French flank and rear in a very dangerous manner at the spot where the removal of Massena rendered their line particularly weak. Meanwhile that Marshal had sent one of his divisions, under St. Cyr, against Aderklaa, and the Frenchmen, penetrating rashly beyond it, and getting somewhat out of hand, had come under a heavy artillery fire from near Wagram, had been charged in flank by the Austrian cavalry and, becoming demoralised, had broken and fallen back in confusion to the village. The Archduke eagerly

availed himself of the opportunity thus offered him, headed his troops in person, and so vigorously followed up the success that he drove his assailants, not only out of the village, but some distance beyond it.

Napoleon marked what had happened from a distance, and with quick decision hastened to retrieve the disaster. He hurried Druôt forward with four Horse Artillery batteries of the guard to check the forward rush of the enemy, the remaining six Field Batteries followed as fast as they could, and soon a great line of about 100 guns was drawn across the breech in the French line and held the enemy at bay.[1] The part played here by these guns was of the first importance, and affords an excellent illustration of the power of the arm on the defensive, although later on, as we shall see, how they were to be thrown into the scale again with even more marked effect in the attack.

Perceiving that the moment was not yet ripe for his great blow, Napoleon sent Massena to stem the Austrian inroad on his left, while Davout was ordered to turn the enemy's flank at Neusiedel. The Austrian right meanwhile had also, however, to experience the power of artillery, for in their brilliant advance near the river they had exposed their right to the fire of the heavy artillery which, as has already been stated, Napoleon had placed in the Lobau. The flanking fire of these guns materially checked the enemy's progress, and, combined with the efforts of Massena, brought him to a stand-still Meanwhile Napoleon rode up and down the fire-swept angle of his line near Aderklaa, and ever and again cast an anxious eye at the tower of Neusiedel which juts out from the plateau of Wagram away to the east. He had determined to wait for the success of Davout's turning movement ere he delivered his great attack on the enemy's centre, and all now depended on the hero of Auerstadt.

The various accounts all agree in praising the coolness and presence of mind displayed by Napoleon at this juncture. The sound of the cannon in their rear near the Danube, had disquieted the minds of soldiers and staff officers alike, and, unable to fathom the Emperor's intentions, they kept drawing his notice to what appeared to them a most critical situation. He rode up and down in silence, and paid but little attention to the murmurs and remarks that began to be heard about him. Massena, having gained an advantage over the Austrian right with the help of the artillery from the Lobau, sent Marbot, as he tells us in his Memoirs, to beg the Emperor to let him make a counter-attack. But the Emperor, intent on watching for a sign of Davout's progress, paid no attention to the message.

Suddenly he was all animation. The smoke of Davout's guns had clearly rolled beyond the tower of Neusiedel. He turned to Marbot. "Go, tell Massena to fall on everything before him, and the battle is won!" Then he called to Lauriston, "Take 100 guns, 60 of which will be from my guard, and go and crush the enemy!" The great

[1] Jomini, in his "Précis de l'art de la guerre," says "Cependant on a vu, à Wagram, Napoléon jeter une batterie de 100 pièces dans la trouée occasionnée à sa ligne pars le départ du corps de Masséna, et contenir ainsi tout l'effort du centre des Autrichiens; mais il serait bien difficile d'ériger en maxime un pareil emploi de l'artillerie." In spite of the dictum of the great strategist, however, we shall, in the campaign of 1870, find the example set at Wagram successfully repeated on more than one occassion.

stroke he had been meditating all day was now to fall. This great battery first shattered the enemy with a heavy fire, then Bessieres charged to the front with six regiments of Currassiers, and, supported by the cavalry, the huge column, celebrated in military history for its immense size, led by MacDonald, was driven through the Austrian centre, and Davout having rolled up his left, the Archduke was compelled to order a general retreat. Although beaten, the Austrians however were by no means demoralised, and but very few trophies fell into the hands of the conquerors. Indeed, on the Archduke's statue in Vienna, "Wagram" is emblazoned as a victory beside "Aspern." That the Emperor did not energetically follow up his success has been variously explained. Some say he was ill, and not, therefore, as energetic as usual. He himself blamed his cavalry. Bessieres was wounded, and Lasalle, the brilliant cavalry soldier, was dead, and therefore, perhaps, the arm was not handled as it otherwise might have been.

But one excellent reason for the Austrians' escape from graver disaster than they experienced is to be found in the action of the splendid body of their artillery which always remained intact, and which covered their retreat with a stubborn courage that cannot be too highly praised.

Indeed, Wagram is exceptionally rich in examples of what artillery can achieve. We have the great opening cannonade on the second day; the ready manner in which it assisted in parrying the first Austrian blow on the French right, and then the concentration of the great battery to close the breach at the French centre. The victorious Austrian right is next brought to a stand-still by the guns in the Lobau, and, finally, the great mass of artillery, against which the Austrian advance in the centre has been shattered, is used by the Emperor when the moment is ripe to open the way for the decisive stroke, long in contemplation, which is to decide the battle. And if the value of artillery in the attack is thus well exemplified, its even nobler *rôle* in stemming the torrent of pursuit is illustrated also in the generous self-sacrifice displayed by the Austrian gunners when their army was compelled to retire.

That the result of this battle was not more decisive has been variously accounted for. The cavalry, as we have said, were blamed by Napoleon himself, and Taubert thinks that the artillery blow at the close of the battle was less effective than that of Friedland because the mass of guns was unweildy, the mobility of the foot artillery inadequate, and the advance of the guns premature. To us it seems, however, that the effective fire of the Austrian guns had a predominating effect in staving off complete disaster. Fifteen French guns were dismounted by them as they moved into position for the final effort, and their conduct during the retreat has already been alluded to. The truth appears also to be that the quality of the French infantry had fallen off. As the continual warfare depleted the sources from which it was drawn, younger and physically inferior conscripts had to be accepted, and there was less time to train them than formerly. Therefore, dense unweildy masses, such as MacDonald's column, were, in the latter years of the empire, substituted for the lighter formations of Austerlitz and

Jena, and, unless the foe were demoralised, which the Austrians were not, such vast bodies must suffer enormously in the attack. Moreover, the Austrians, since their victory at Aspern, had ceased to regard these great French columns with the same dread they had once felt for them, and the effect of such crowded masses was at all times chiefly moral. These various causes will probably more truly account for the absence of trophies than any defects in the handling of the artillery, to whom, on the contrary, such success as crowned the day may in a large measure be traced.

Henceforth we shall find Napoleon relying more and more on his artillery, and as the inferior quality of the infantry demanded increased support, the proportion of guns with his armies steadily grew.

At Borodino he brought an immense battery of guns to bear on the Russian centre, but beyond the fact that it may serve as an illustration of the most effective manner of handling the arm, the action of the artillery in this battle can hardly be regarded in the light of a brilliant achievement.

In the following year, however, when the Emperor, tottering to his final fall, was standing at bay against the allied strength of Europe, we may find his artillery doing splendid service for him on many fields. Our first example will be from the battle of Lützen[1], or rather from the combat which preceded that battle in which the gallant Bessieres, Duke of Istria, lost his life.

The losses of the terrible expedition to Russia had reduced Napoleon's force of light troops and cavalry very much, and consequently in this campaign he had to move with great caution, not being able to feel for his enemy as he advanced. On the 1st of May, 1813, in crossing the defile of Grünebach, near Lützen, he encountered the Allies strongly posted, with six guns, on the heights of Poserna, to bar the great road which leads from Weissenfels to Lützen and Leipzig. Being without due means of observation, the French infantry were moved forward in squares, just as in our day, it has been found necessary to move our forces in South Africa and the Soudan. Such a formation naturally led to heavy losses from the guns on the opposite heights, Bessieres was killed as he rode forward to try and reconnoitre the enemy's position, and 300 men fell without any advantage having been gained over the foe. While matters were at this crisis twenty guns of the guard were sent for, and under their fire the squares were once more able to push forward. As they came on, supported by the guns, the enemy gave way before them, and left the path to the plain of Lützen clear. The French thus succeeded in occuping Lützen and pushed on the next day towards Leipzig. It was on this very ground that, in 1632, Gustavus Adolphus had received his death wound in his victorious battle with the Imperialists, and the associations connected with the famous battle-field could not fail to rouse a special and romantic interest in the minds both of officers and men.

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[1] Sometimes spoken of as Gross Görschen.

BATTLE OF LÜTZEN; 2nd May, 1813.

Meanwhile the Allies had determined to try and turn the French right and cut them off if possible from the Saale. Thus both armies divided into columns, for facilities in marching, stumbled upon one another, and soon came into collision. The Allies, preceded by a strong artillery, and coming on in superior numbers struck the corps on the right of their opponents under Ney, at the village of Gross Gösrchen. The French infantry were pounded by the great mass of guns which preceded the advance of their opponents, and although they offered a most obstinate resistance, were driven from the village, and also from Klein Görschen, and Rahna which they also vainly endeavoured to hold.

Clearly his enemies were learning in constant defeat the secrets which underlay many of their conqueror's successes.

Urgent messages for help were sent to the Emperor, who at once called the columns of MacDonald and of his son-in-law, the viceroy—who, however, with a soldier's instinct had anticipated the order—to the threatened point, while Marmont and Bertrand were also urged to move in the direction of the fighting, towards which he himself also hurried immediately.

But Ney had brought up reinforcements in the mean time, and had driven the Prussians from the villages, almost back to their former positions. Not, however, for long, for their second line was now led up to the aid of the first, and not only drove the French columns once again before them, but, the allied reserve following up their success, Kaia, the key of their right was speedily captured and set on fire.

It was now 6 o'clock, and the French right had been driven back a

mile-and-a-half and was more or less disorganised. Victory seemed within reach of the Allies, and their splendid force of cavalry prepared to sweep over the plain round the rear of their enemy, who had no adequate force of the arm with which to oppose them. Napoleon exposing himself in the most courageous manner, as he had done at Wagram, hastened to the menaced point, and made the most energetic personal efforts to retrieve the day. He collected the remnants of Ney's corps behind the burning village, reinforced them with the division of Ricard, and launched them on a fresh attack. Reanimated by his presence, the French infantry succeeded in pressing their opponents back to Klein Görschen, but then the combat surged indecisively to and fro, both sides lost enormously, but neither would give way.

Time, however, which was what Napoleon chiefly needed, had been gained. While the fight raged between Kaia and Klein Görschen, the other French corps were creeping nearer, and the formidable Imperial Guard was being massed behind the hills of Kaia by the Emperor for a decisive blow. Soon seventy thousand French were pressing the Allies, who had only forty thousand with which to oppose them. As a last effort Wittgenstein called the artillery of Winzingerode to his aid, and placed them so as to take the enemy in flank as they came on between the villages. Guns, thus opportunely thrown into the scale, could not but relieve the pressure, and in truth the Allies gathered heart with their support, and once more drove the French out of Klein Görschen, and from round Kaia back to where Napoleon was mustering his guards.

The Emperor saw that the moment for him to make his great effort was now ripe, and his blow fell as it had fallen at Wagram. Sixty guns of the incomparable Artillery of the Guard were formed into a great battery under Druôt, and were sent forward to prepare the way. Then when their fire, which was served with a rapidity and precision such as their opponents could not match, had produced an effect, sixteen battalions of the young guard moved to the attack, and the whole of the reserve cavalry, cherished carefully during the day with this object in view, supported the movement. As the great column swept on, the guns, manœuvred with splendid skill, kept ahead of it, and their fire was irresistable. Kaia was soon passed, but round Klein Görschen the fight remained again stationary.

The effort of the Allies, however, had been in vain. They were beaten back, if not routed at the decisive point, and as night closed in they could not but realise that they had failed. Napoleon's favourite manœuvre had once more been successful, and the result was due principally to the manner in which, at the supreme moment, his guns dominated the fight at the spot where his effort was centred, and the honours of the day were with Druôt, as at Friedland they had been with Senarmont.

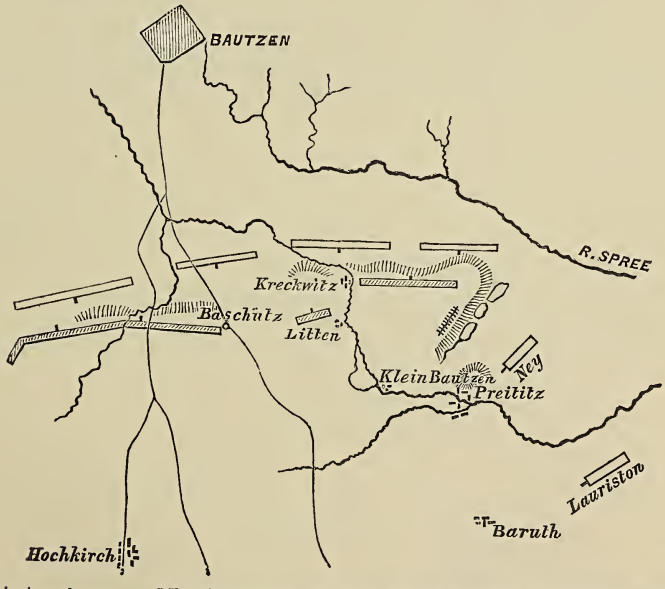
The next morning the Allies felt unequal to renewing the struggle and retreated.[1]

[1] Taubert quotes the following instance of the great effect of canister on attacking troops from this battle:—"A single 6-pr. which had been upset, and had to be righted before it could follow the battery, was attacked by the French hussars. The non-commissioned officer in charge put a round of canister over the ball already in the piece, and fired with such effect as to completely disperse the hussars who had come up quite close to the gun. Nor did an infantry column which advanced on it at the same moment fare better, although they had looked on the piece, which was almost abandoned, as an easy prize.

At Bautzen, three weeks after the battle we have just described, Napoleon again found himself opposed to the allied Russians and Prussians, and was to learn at the hands of his opponents the effect which guns skilfully placed in position may produce.

On the second day of the battle (the 21st of May) Napoleon, while with the bulk of his army he assailed the centre and left of his foes, directed Ney to turn and surround their right, his orders being to move on the steeple of Hochkirch, so as to get completely in rear of the enemy. Lauriston was also detached to move by Baruth in the same direction. Ney did succeed in capturing Preititz, a village quite in rear of the Allied position, but Blucher being determined to retake it sent twenty Prussian guns to play on the flank of his dense columns. The effect of these guns advantageously placed as they were, was such as to cause Ney to swerve from his true direction and establish himself on some heights near Klein Bautzen, from which his artillery could reply on more equal terms to that of the enemy. The village of Preititz had also to be abandoned, and ere Ney could again advance he had to wait two hours for his reserves to come up. The check thus brought about probably saved the Allied army from total destruction, for the delay and vaccillation of Ney enabled its leaders to take measures to ward off his menace, coming as it did from an unexpected quarter, and to prepare for a general retreat.

When Ney did eventually resume his attack the golden opportunity for decisive success had passed away, the chaussée through Hochkirch, in rear of the whole army of his opponents, could no longer be gained, and the day, which might have been crowned by a total rout, could only end in a victory.



[1] Jomini, who was Ney's chief of the staff in this action, quotes this

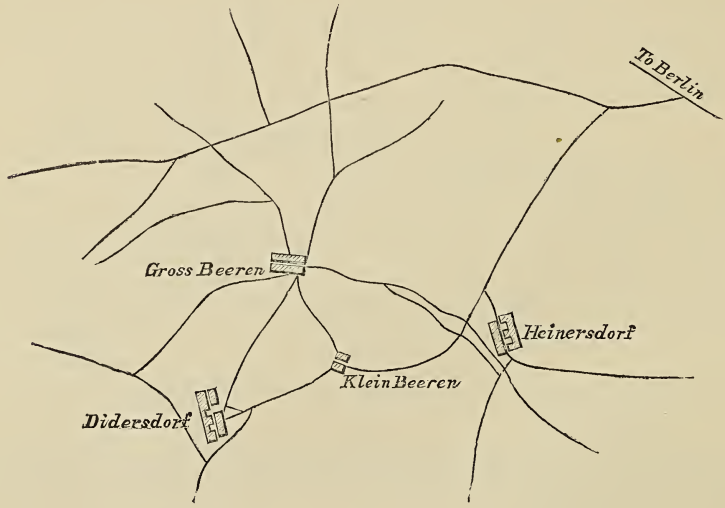
[1] Précis de l'art de la guerre.

incident as an example of what the flanking fire of artillery is capable of accomplishing.

From this same battle Taubert gives as an illustration of the power of guns to defend themselves, the conduct of a Prussian Horse Artillery battery (Zinken's), in beating off the attack made on it by a battalion of infantry, and so throwing it into confusion by its canister fire that it was compelled to lay down its arms.

At the battle of Gross Beeren, a few months later in the same year, the part played by the artillery on both sides was very considerable, and indeed this may almost be termed a purely artillery combat, because the pouring rain in which it was fought confined the infantry to the use of the bayonet alone. The battle was also remarkable from an artillery point of view, because it furnishes us with an example of artillery masses brought early into action after the manner which the Germans have made the fashion in the present day, and of a close co-operation of guns with the final assault, such as their mobility had hitherto scarcely rendered possible. Napoleon, whose eyes were ever fixed on Berlin while he fought the Allied armies round Dresden, had despatched three corps under Oudinot to operate against Bernadotte, who was in command of the Allied force which was covering the Prussian capital.

On the 23rd of August, Oudinot directed Regnier to attack Gross Beeren with the 7th Corps, and the French coming on in superior numbers easily gained possession of the village, and established themselves close to the very centre of the Allied line. The same day Oudinot was himself engaged with the enemy on the left, while Bertrand was also fighting on the right. The three corps were separated by difficult country, and united action between them was impossible. The Allied reserve under Bülow had moved to its left to support Tauentzein against Bertrand, but, the situation at the Allied centre becoming critical, he was recalled to oppose Regnier's dangerous



inroad, and advanced to the support of the centre, which was clinging to some woods behind the village, with his whole corps from Heinersdorf. The ground being favourable for the employment of artillery, and the heavy rain having rendered muskets useless, the Allies covered their advance with a great mass of guns, which preceded the infantry and commenced the engagement in an unusually bold manner.

Thirty-six Prussian pieces and a Russian 12-pr. battery under Lieut.-Colonel von Holzendorf opened fire at 1800 paces, and kept up a lively cannonade, while the guns pressed forward by alternate batteries. The infantry followed at a distance of 300 paces. The French guns were numerous and caused much destruction to the Allied artillery. It, therefore, speedily became necessary to reinforce it, and sixty-four pieces were accordingly brought up within 700 or 800 yards of the French position, and soon this number was further increased to eighty-two, while a Swedish battery was sent to the right to take the French in flank. Regnier's artillery ere long began to show the effect of this concentrated fire, and by degrees became almost completely silent. Then Bülow led his infantry to the attack, and their enemy's position was carried at the point of the bayonet.

When this advance was made Colonel Holzendorf mounted his gunners on the carriages of the 6-prs., in a manner then quite original, and they were thus enabled to press forward rapidly and co-operate with the infantry at the shortest ranges. The village was soon gained by this well prepared assault, and the defeat of the French, who were cut off by the nature of the country from any help from their comrades on either side, was completed by the cavalry of the Allies. Holzendorf's promptness in mounting his gunners and pressing on with the infantry has been much praised, and, indeed, the manner in which the artillery was handled throughout the day appears especially deserving of notice. While the early massing of guns must chiefly attract attention, it should also be noted that the foot and horse artillery were likewise separated in an unusual way, and, while the former acted against the front, the latter engaged the flank of the enemy's position.

General Bülow [1] in his account of this battle has warmly eulogised the courage shown by officers and men, and has particularly praised the activity of the artillery, which contributed so largely to the victory, not only by its concentrated fire at the commencement of the fight but by the general manner in which it subsequently supported the advance.

[1] "Recueil des plans de combats et de batailles livrées par l'armeé Prussienne, 1813–1815."

(To be Continued.)

FIRE DISCIPLINE; ITS NECESSITY IN A BATTERY OF HORSE OR FIELD ARTILLERY, AND THE BEST MEANS OF SECURING IT.

BY

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"ARMA VIRUMQUE."

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THE question of "Fire Discipline" is one that has greatly exercised the minds of many gunners during past years, and yet, if the works of writers on artillery subjects be consulted, it is very difficult to satisfy oneself precisely as to what is generally understood by the term. By some it is confused with "Fire Tactics," by others with "Discipline under Fire."

The only writer who has attempted a definition is Lippman (*Revue d'Artillerie*, Vol. X., p. 344), as follows :—

"*. . . . the simultaneous and regular action of all the constituent parts of the battery; the unshaken performance of their duties by sectional and gun commanders and by gun-layers; the complete absence of any hesitation in picking up and ranging on the indicated target and in carrying out any alteration in elevation, &c., that may be ordered; in short, such skill and rapidity of administration that the fire of the battery can be kept up quickly and continuously without any hitch.*"

This definition, no doubt, lacks crispness, but it is sufficiently clear to demonstrate the meaning accepted among Continental gunners; it points entirely to the technical administration of fire by the Battery Commander, and is quite outside the question of "Fire Tactics." These latter are in the hands of the Commander of the Brigade Division and the higher commanders, who order the application of the fire of their commands to the various objectives in succession, in accordance with the tactical requirements of the situation and, themselves, take but little part, beyond a general control, in the actual working of the batteries, unless the failure of Battery Commanders demands direct interference. Their attention is, or should be, almost entirely taken up with tactical considerations.

Hamley has defined "Discipline" as "the cohesion of the units the suppleness of the mass," and such definition may be applied to "Fire Discipline;" the cohesion or working together of all the units of the battery in order to bring about the flexibility of its fire, or the power of applying it in any desired direction.

In the days of smooth-bore ordnance a system of "Fire Discipline," as we now understand the term, did not exist, indeed, there was no necessity for it. The short ranges at which guns were fought, the ease with which the effect of fire could be observed by the gun-layers themselves, the simplicity of the ammunition and the fact that much more of the fighting was done with grape and canister than is now-a-days done by case, all pointed to and sustained the gun as the fighting unit. The Battery Commander troubled himself but little with the technical administration of the fire, reserving his attention for tactical considerations; the battery being, at that time, looked upon as the tactical unit.

But these same short ranges brought into great prominence a quality for which our British gunners have long been eminent, even among the stolid races of the north, and that is "Discipline under Fire," or the unflinching and almost mechanical performance of their duties under the excitement of an engagement, even at case ranges. This, we hope, they retain unto the present day, but, referring to Lippman's definition, it will be seen that something more than "Discipline under Fire" is required to constitute "Fire Discipline," namely, ability on the part of the Battery Commander to administer the fire of the battery as a whole, instead of the tactical application of the fire of an agglomeration of six semi-independent pieces.

This great revolution in practical gunnery was brought about by the introduction of rifled guns. At the ranges at which actions now commence it is no longer possible for the gun-layers to observe the effect of fire, from which to correct the elevation of their guns; the extensive front, also, of a modern army in battle array presents a very varied choice of target and demands the careful indication of the portion of it to be laid on, in order that the fire of the battery may not be frittered away. These duties of indication, of observation, and of adjustment of elevation have been placed upon the Battery Commander, his six guns being gathered to him as the modern fighting unit, and, the onerous nature of this charge making it all-absorbing, he has been relieved from those tactical considerations which were, heretofore, his principal care. These tactical duties are now assumed by the higher commanders and the Officers Commanding Brigade Divisions, which have now become the tactical units.

With the above in view, we may formulate the following definition:—

"Fire Discipline is the combination of those qualities within a battery which enables its commander, in the shortest possible time, to turn fire of any desired nature and rate upon any portion of the field at will."

We thus accept the Continental definition, that "Fire Discipline" is confined entirely to the technical administration of the fire of the battery, and it has to do with:—

(*a.*) The pointing out of the objective.
(*b.*) The opening of fire.
(*c.*) Ranging.
(*d.*) The continuation of fire.
(*e.*) The supply and replenishment of ammunition.

The mere recital of these headings is sufficient indication of the necessity of Fire Discipline in a battery, whether Horse, Field, Mountain, or Garrison, for without the correct performance of any one of them the action of the guns might prove abortive, however perfect the tactics, drill, and discipline under fire might be.

Although there is no dispute as to the necessity of Fire Discipline, there has been some expression of disapproval at the prominence given, of late years, to the cultivation of this quality, and some of our officers fear that, in paying great attention to it we are losing, or may lose, the facility in manœuvre for which our artillery has long been famous.

Prince Hohenlohe has said, "the proper objects of the arm are timely arrival upon the field of battle and good practice when there," thus placing good shooting, in which Fire Discipline plays so leading a part, upon an equal footing of importance with facility and celerity of manœuvring. It is self-evident that, if the arrival of the guns be timely, it is useless if they cannot shoot well when there, and it is equally indisputable that, however well artillery may shoot, it is of no avail if its effect be not applied at the right time and place.

With the necessity of manœuvring power our artillery has long been impressed, and, in respect of it, is second to none; but the importance of the possession of a high state of Fire Discipline has only lately dawned upon us; because we have never, since the adoption of rifled arms, been obliged, by an equal enemy, to feel the want of this vital element of success upon the battle-field. When we became fully aware of our failing in this direction, and we are lucky not to have had it forced upon our notice by disaster, it is but natural that a great prominence should have been temporarily given to the question in our endeavours to make up for lost time. This may account, somewhat, for the seeming diminution of importance attached to the quality of mobility, on which, hitherto, all our energies were concentrated. This relaxation is not real, and its apparent existence has been brought about by the enforced attention to a comparatively new subject, which has occupied the greatest share of our thoughts for the moment, an attention that will assume its just proportions when we have brought Fire Discipline on a par, as regards efficiency, with the other great quality of the arm already possessed by us in a high degree.

Having defined Fire Discipline, let us now enter more in detail into its constituent parts, as enumerated under the headings given, and then we shall be able to see upon whom the responsibility for the correct performance of various duties rests, and determine what manner of training and instruction is necessary to attain a high state of efficiency.

(*a.*)—Pointing Out the Objective.

The *selection* of the objective, which is governed by tactical considerations, is the province of the Commander of the Brigade Division, who will receive orders from his Divisional General, in the case of one of Brigade Divisions of the Corps Artillery from the Officer Commanding that body, or, in the case of the Corps and Divisional

Artillery being massed, from the General Officer Commanding the Artillery of the Corps. The selection then comes under the heading of "Fire Tactics," but the indication of the objective is where "Fire Discipline" first comes into play.

In the stages of a battle preceding and including the Artillery Duel, it is assumed, in foreign regulations, that the artillery will, as a rule, give the first indication of its presence by the opening of its fire. In order to take full advantage of this fact, it is prescribed that, whenever the ground is suitable, the batteries shall take up a preliminary position under cover as close as possible to the firing position and that, while there employed in preparing for action, the Commander of the Brigade Division shall call to the front the Battery Commanders and point out and apportion the target among them. Having taken up the position they intend to occupy in action, and thus marking for the windward flanks of their batteries, the Battery Commanders, in their turn, call forward the Section Officers and gun-layers and point out to them :—

1. The portion of the target allotted to the battery.
2. The ranging point, if any.
3. Any special orders about the distribution of fire.
4. The nature and rate of fire and the flank from which it is to begin.
5. The elevation for the first round.
6. The general alignment of the battery.

This having been done, the gun-layers spread out into the positions that their guns will occupy in action.

In the above manner the thought, the tactical idea, is communicated from the brain of the army to the hands that are to carry it into effect, and the operation of pointing out the objective is the connecting link between "Fire Tactics" and "Fire Discipline."

It must not be supposed that there will always be time and opportunity for this preliminary reconnaissance of the enemy and occupation of a preparatory position, but, whenever facilities for it exist, the gain of so obvious an advantage should not be neglected.

(*b.*)—The Opening of Fire.

One of the principal points to be kept in mind in opening fire is that it should come upon the enemy as a surprise; with this in view, all preparations should take place under cover and, if the position is on the reverse of a slope, the guns, already loaded in the preparatory position, should be unlimbered and run up to the crest by hand.

If the battery has to advance within view of the enemy before coming into action then endeavour must be made by speed of movement and excellence of Fire Discipline to compensate for the disadvantage of the fire not taking the enemy unawares.

The reason why surprise is so important is, that if a battery commences to range itself before the enemy are aware of its presence then, in all probability, it will complete its ranging before the enemy does so and be the first to open an effective fire of shrapnel; under these circumstances, such is the murderous effect of modern shrapnel,

Continental experience tells us that the ranging of the enemy is little likely ever to be completed in a satisfactory manner at all.

When these things are considered it will be seen why such stress is laid upon a preliminary reconnaissance of the target by the gun-layers, who are thus enabled to go straight to work directly their loaded guns come up on to the position, instead of having to wait while the target is indicated to them and necessary orders about fire are given. It means a saving of time of from two to four minutes, at least, between the time of coming into view and the opening of fire, and hence the commencement of effective fire, which may be sufficient time in which to get the start of the enemy in the ranging process and thus hinder him from ever ranging himself properly.

(*c.*)—RANGING.

The determination of the elevation to be given to the guns in order that the mean trajectory of the battery may pass through the target and the determination of the correct length of fuze.

In no period of the fight is speed combined with accuracy of such vital importance. "The victory will be to the battery that first finds the range," says a foreign writer of eminence, and, for reasons given before, the truth of this adage is sufficiently obvious.

In speaking of ranging generally, there are two main points that arrest our attention, viz :—

The system of ranging.
The observation of fire.

The System of Ranging.—When, some five years ago, the active attention of our artillery, as a Regiment, was first turned earnestly to the consideration of our backwardness in modern methods of fire, we were fortunate in being able at once to adopt, more or less completely, a system of ranging that had been the outcome of 15 or 16 years of patient labour and investigation by other Powers, notably the Germans. The long trials which the "Bracket" system has undergone and its gradual evolution from other less successful methods mark it as the best we could have adopted. Other systems, or perhaps rather modifications of the same system, such as the "*echelon de distances*," have had, and still have, a few advocates, but the simple system, as adopted by us from the German, still holds its ground and appears likely to do so, both on account of its simplicity and its easy adaptability to varying circumstances. The details of our system are too well known to need discussion in this place; the method of training to ensure their correct execution will be touched upon later on.

Observation of Fire.—Within the limits of space imposed for this essay it is impossible to deal adequately with this important factor of Fire Discipline, of which the difficulties and the means of overcoming them would alone fill many pages. Upon accuracy of observation depends successful ranging, hence the effect of the fire of the battery and its capability for useful employment. Observation is always difficult under service conditions, but much may be done to perfect the power by practice and the cultivation by the Battery Commander of a

sportman's eye for the country, which alone can compete with unforeseen difficulties of ground, light, background, &c.

(*d.*)—Continuation of Fire.

Under this heading come the important subjects of rate, succession, and distribution of fire.

Rate of Fire.—Is governed by the importance of the object in view and by the economic question of the supply of ammunition.

Whatever rate is employed it should be regular, in order to counteract the tendency of the fire to become hurried under the growing excitement of the men as the action progresses. If possible, that rate of fire should be selected which will ensure the ammunition supply not being exhausted before a fresh supply comes within reach; this, however, is not always feasible, as tactical requirements or pressing danger may call for a rapid expenditure.

The subject of the replenishment of ammunition will be referred to later.

Succession of Fire.—A succession of fire once ordered should be strictly adhered to, the irregular discharge of the guns being the first sign that the battery is getting out of hand. This succession should be right through the battery from a flank and is determined and ordered by the Battery Commander. Should any other succession be necessary, such as that through two batteries, then it will be ordered by the higher commanders and the line of batteries told off accordingly.

It is sometimes necessary to employ fire by sections, viz., when firing at a quickly moving target, especially when case shot is used. This method should be employed with caution, as it may, to some extent, relax the hold of the Battery Commander over the fire of his battery, and would be very likely to do so in the excitement of a cavalry charge being pushed home.

Distribution of Fire.—The rules which influence the selection of any particular method of distribution are, to a great extent, an element of "Fire Tactics" and should thus be taken into account by the Commanders of Brigade Divisions in apportioning the target among the batteries. But the actual distribution, as carried out by the medium of Fire Discipline, is, naturally, part of the duty of the Battery Commander.

It is a subject which, though capable of variation according to circumstances, is barely noticed in our drill-book, and then as if there were only one nature of distribution. Although, until lately, it has received such scant attention from us, abroad great stress is laid upon an early distribution, as an important step towards securing immunity from the effect of the enemy's fire by making our own felt, and importance is attached to the study of its different natures.

It should be impressed upon gun-layers that the normal state of the fire of a battery is a distributed fire, and that concentration for ranging purposes is an unavoidable evil, to be evaded when possible. This does not apply, of course, to the concentration of the fire of several batteries against a tactical point.

(*e.*)—Supply and Replenishment of Ammunition.

This is apparently but a side issue to the question of Fire Discipline, if we omit the actual service of ammunition to the gun, but, in reality, it is an issue of the greatest importance, directly influencing, as it does, the possibility of the continuation and the safe rate of fire.

In adhering, up till lately, to a system of supply from the limbers, we have been behind the times, but a system based on modern experience is already in practice to a certain extent. This latter fulfils the necessary conditions, in that ammunition in the gun limbers is drawn upon last, that gun and wagon teams are kept out of fire directed on the guns, that the position of the ammunition columns upon the line of march can now be such that there is every reasonable expectation of a fresh supply of ammunition being available about two hours after the batteries have come into action, that is, before they would have exhausted the ammunition in their own limbers and wagons at the rate of ordinary fire.

It only remains for us then to practise and perfect this scheme, but that is precisely what is not done to a sufficient extent. On field days the enormous amount of ammunition expended in the artillery duel and preparation of the infantry attack is usually represented by a few rounds only, fired to "mark the position." It is seldom brought home to batteries what it is to run short of ammunition.

The sort of training required for the practice of ammunition supply is a long field day against a marked enemy, the guns should remain in position as long as they would on service and the ammunition expended should be actually withdrawn from the limbers and wagons and, either placed in transport wagons or left upon the ground to be recovered afterwards. The wagons representing the ammunition columns should be started some 10 or 15 miles from the scene of action. The replenishment and packing of ammunition in the field would thus be brought before the battery practically, doubtless with enduring results.

In the same way at practice, the daily expenditure per battery is so small that practical replenishment, with its too-little-practised repacking, rarely takes place.

As regards the superintendence of the replenishment of ammunition, the Captain, assisted by the Sergeant-Major and the Quarter-Master-Sergeant, is best able to take it in hand, and it must be his constant care that, not only is the battery kept fully supplied but that it is always in a state to move forward with at least the gun limbers full for immediate expenditure.

Duties of the "Personnel" in Respect of Fire Discipline and the Training Best Suited for Ensuring the Correct Performance of the Same.

The Officer Commanding the Brigade Division.—Although the duties of this officer are primarily tactical, he has the responsibility of a general control and regulation of the fire of his command and the following duties are performed by him for the furtherance of Fire Discipline among his batteries.

1. To point out the objective to Battery Commanders and apportion it among them, telling off, if need be, certain batteries to range and others to join in the fire after the ranging is completed; this to ensure that no confusion in observation may arise during ranging, owing to a large number of projectiles falling about the same place at the same time. In dividing the target among his batteries he will be influenced by considerations of Fire Tactics, with respect to the kind of distribution of fire that will best effect the end he has in view. The above is the connecting link between "Fire Tactics" and "Fire Discipline."

2. So to place his batteries on the chosen position and, if necessary, to give such initial orders for the succession of fire, that the smallest possible amount of inconvenience may be caused to batteries by their own smoke and that of other batteries. This is to facilitate Fire Discipline by giving it free scope.

3. To determine generally the rate of fire, with a view to economy of ammunition. This will, as a rule, depend upon tactical considerations; if a delaying or tentative action is being fought then, most probably, he will order "Slow" fire, whereas, if it is desired to force a solution quickly, he will order that the general rate of fire be "Ordinary" or even "Rapid." This is rate of fire looked at from a fire-tactics point of view.

4. He will cause himself to be kept informed of the amount of ammunition available and of the positions of the second lines and reserves.

5. The choice of projectile is generally left to Battery Commanders, the most noticeable exception being that the Commander of a Brigade Division, or larger force, sometimes desires to keep the battery on an outer flank firing common shell, or, at all events, percussion projectiles, so that he may be able to order the fire of this battery to be turned rapidly on to any new objective for ranging purposes.

6. When the ranging of the batteries is completed, and the various elevations and lengths of fuze have been communicated to him, he will compare these with one another, keeping in view the relative positions of the different portions of his line and those of the enemy. He will, if necessary, order any battery to re-verify its elevation or length of fuze, if he considers that an error has been made in the first instance. He will communicate such information as may be necessary to the different batteries, with a view to a possible concentration of fire.

7. He will keep a general control of the fire and observe its general effect, this, from his semi-independent position, he should be well able to do, and, at times, he may be kept informed of this general effect by a flank observing party.

8. He will NOT interfere in the interior working of batteries, unless he sees that the Battery Commander is unequal to the task before him. If he does so interfere it is at the imminent risk of losing sight of those tactical considerations which are his peculiar province.

9. He will remain, as much as possible, in the same place, so as to be readily accessible.

It is obvious that no Commander of a Brigade Division can apply

the fire of his command to the best advantage unless he is fully aware of all the technical difficulties of observation, &c., with which Battery Commanders have to contend, for it is by his action, as enumerated in paragraphs 1 and 2 above, that some of these most grave difficulties can be mitigated, and, if he has not suffered from them himself, he is little likely to give sufficient attention to them. The best training, therefore, that he can have is that of Battery Commander and it is essential that he should have had it, otherwise he will not be in touch with his subordinates in respect of their difficulties.

This training must be supplemented by occasional field days where time can be given to the discussion of the application and administration of fire. The Brigade Division should be deployed with a definite tactical idea against a definite target, every operation should be gone through and discussed to the minutest detail. Ordinary field days, when other troops are employed do not, as a rule, lend themselves to this class of exercise, which can be best performed when the Brigade Division is out alone and operating against a marked enemy.

The Battery Commander.—

1. To point out the position of the target allotted to the battery and to select a ranging point.
2. To range the battery, involving careful observation.
3. To distribute his fire to the best effect.
4. To arrange for the continuance of fire in accordance with instructions received and with a view to the most advantageous and at the same time most economical expenditure of ammunition.
5. To be prepared at all times to change his target, as may be ordered.

In this epitome of an artillerist's duties there are two salient features. To be successful a Battery Commander MUST be able to command and SHOULD be able to observe. The second point may be evaded by the use of a trained observer, but from the first there is no escape. Not only must he be able to command but he must be intimate with every detail of the process of ranging, with every principle of the application of fire, with the exact value under different circumstances of each nature of projectile at his disposal, so that, once committed to action, the fire may flow rapidly and smoothly, without pauses for calculation, without stoppages for thought and consultation. Not only must he be thus highly educated, but also, by constant drill and instruction, in close contact mentally with his men. He must feel assured, when his eye is glued to his telescope watching the effect of his fire, that the battery behind him is working as quietly and effectively as if his eye were upon it, otherwise his attention will be distracted. When committed to action, or to service practice, it is too late to think of training the battery, and a Battery Commander must stand or fall by the previous training that he has given to it; indeed, if he endeavour to correct minor faults of internal working he will lose his grasp of the battery as a whole; for this reason he should

stand, and keep, to a flank, at least until the ranging is completed and the battery has settled down to a distributed fire.

One of the most effective means of training for a commander and his battery, is battery gun drill, or, as some officers call it, Fire Discipline drill.

A Battery Commander's duties demand so much of his attention that it would be well if we enforced in our service some of the stringent orders from foreign regulations on the subject of interrupting him. If an orderly is sent to get some information regarding elevation, &c., he is not allowed to address the Battery Commander directly, especially during ranging, for fear of disturbing the thread of the process. The question is either asked of a Section Officer or the orderly waits for the next word of command, which will give him the requisite information.

Criticisms of a battery at practice should, for these reasons, be reserved until the conclusion of a series. A Battery Commander, deep in observation, does not want to have his attention withdrawn to the fact that his limbers are moving to the rear at an unauthorised pace, or some such comparatively unimportant detail. The order "Do not speak to the man at the wheel" should be strictly enforced.

The training of a Battery Commander must be progressive from that of Section Officer and must be kept at fighting pitch by almost daily battery gun drill and by seizing every opportunity, when other batteries are practising, of exercising his powers of observation of fire.

The Captain.—The understudy of the Battery Commander; and, when it does not happen that he is placed in charge of the massed 2nd line of wagons of the Brigade Division will, when the battery is in action, practically be in charge of everything but the guns. He will place the limbers under cover and will constantly move about in the battery, watching the expenditure and arranging for the renewal of ammunition, seeing that duties are correctly performed and that casualties are quietly and quickly replaced. He should, as soon as possible, by listening to words of command, ascertain what the target, elevation, &c., is so as to be able to replace his Battery Commander upon occasion. It must be understood that when he is in charge of a massed 2nd line he would not be allowed to leave his charge.

Section Officers.—Although allowed but little initiative during practice, the Section Officers are important links in the chain of Fire Discipline, as the channel of communication of the orders of the Battery Commander to the gun detachments and as supervisors to see that these orders are correctly carried out.

Not only in this executive function is their duty an important one, but in the training and preparation of their sections they have one of equal moment. To this end they must themselves be thoroughly well educated in all the technical work of a battery and, more than that, they must be able to impart their knowledge to the dullest intellects, for the Battery Commander is dependent on them for the selection of layers and the instruction of recruits.

The Sergeant-Major.—Is in charge of the limbers, under the direction of the Captain, unless that officer is otherwise employed. If the services of the Captain are not available in the battery, then the Sergeant-Major, having placed his limbers in safety, will assume those duties in and about the battery ordinarily performed by the Captain, which cannot be attended to by the Battery Commander, whose attention is taken up by watching the effect of his fire, or by the Section Officers, whose attention is taken up by the care of the guns and gun-detachments of their sections.

The Quarter-Master-Sergeant.—In charge of the 2nd line of wagons, under the direction of the Captain, will find sufficient work to do in forwarding filled wagons to the front on the demand of that officer, empty ones to the rear to the Divisional Reserves and in attending to re-packing of ammunition in partially expended wagons and of the kits, &c., of dead and wounded men.

N.-C. Officers and Rank and File.—In the thorough training of the rank and file for the performance of their duties in respect of Fire Discipline, which it is needless to recapitulate here, lies the solution of almost every difficulty, with the exception of those of observation of fire, with which Battery Commanders have to contend. To this object then should our concentrated energies be turned while there is time.

Our first duty to the recruit is to make him a soldier, our second to make him a gunner. On his being a soldier depends his discipline under fire, on his being a gunner depends a large portion of the other items which go to constitute Fire Discipline.

By rigid drill the recruit tends to become an automaton and its chief object is to make the movement of the moment absorb so much of his attention that the predominating emotions of fear or rage may be, for the time being, in abeyance. But we do not want altogether an automaton, we want a living being, capable of handling a somewhat complex equipment with intelligence. Therefore, as soon as our recruit has learnt to subordinate his will to that of others, the cultivation of his intelligence must advance *pari passu* with the training of his body. Indeed, the latter will advance the more rapidly if frequent breaks are made during which the mind may be stimulated while the body rests.

It is a great mistake in the early instruction of the rank and file to attempt to impose upon what is too often a fallow memory the burden of remembering dimensions, manufacturing details, &c., or, for the matter of that, terms of theoretical gunnery. It must be remembered that but few men in a battery bear any responsibility involving an accurate knowledge of the theory of flight; and here we are at an advantage over our comrades in the infantry, where each man is responsible for the shooting of his own weapon and some such knowledge is necessary.

But, while deprecating the forcing of unseasonable food upon minds unfitted to receive it, too great importance cannot be attached to the careful and complete education of gun-layers and non-commissioned officers.

We have, at present, much progress to make in the education of our gun-layers, although a vast improvement has followed upon the recent change in the nature of the competitive practice. Owing to a good

deal of the training in laying being carried out on the barrack-square, gun-layers are not sufficiently adept at laying on service objects or in picking them out when verbally indicated. They can lay on a chalk mark on a wall with the greatest nicety, but, told to lay on some natural feature of the ground 2000 to 3000 yards distant, they usually feel the want of a distinct point to lay upon. Tell a man to lay upon a house, he will usually select the top of a chimney or a gable end, as presenting the sharply defined point to which he has been accustomed, rather than a "service" portion of the wall behind which an enemy might be esconsed. All this must lead to uncertainty on service, whereas peace training ought to induce confidence.

Layers, then, should be trained as much as possible in the open country, and made to lay on targets such as would present themselves on service.

With regard to the training of non-commissioned officers, Section Officers should make it their special object to advance the education of these men, by constant supervision and conversation, by discussing with them, down to the minutest detail, every process embodied in the word Fire Discipline.

When the purely automatic standing gun drill for a single gun has been learnt the best possible training for a battery and its commander is "battery gun drill," and this not upon a barrack-square, but in the open.

On the Preparation and Use of Drill-Books.

With every laudable desire for completeness, it is not possible to lay down procedure suitable for all cases, therefore it is best to cite only principles upon which such procedure should be founded, with an example adapted to most common circumstances. It should then be left to the skill of Battery Commanders, brought to a high pitch of perfection by careful training, to adapt those principles to local circumstances.

The great difficulty with which we have to contend is the idea, in which so many of us have been brought up, of a cast-iron method of procedure as laid down in a drill-book, which HAD to be followed. True, the procedure dealt more with manœuvre, inculcated careful dressing, correct intervals, intricate brigade and battery movements, to the almost total exclusion of any consideration for fire effect; but, now that we have come to look upon fire effect as of equal importance with manœuvring power, we find that it is impossible to lay down, within the limits of a "hand" book, procedure applicable to every imaginable case.

Officers are thus, to a certain extent, left to their own resources, and if they are sufficiently imbued with the principles upon which artillery fire should be conducted, they should not be at a loss; certainly the support given by the old drill-book in respect of manœuvre cannot now be given in respect of fire. Indeed, as our military education improves, the tendency becomes more marked to trust more to the common sense and ability of officers than to attempt to trammel them by the red-tape leading strings of a drill-book. This is instanced by the gradual diminution in bulk of these volumes.

Artillery must ever be judged by the timely effect it produces and it is no defence of failure to say that the circumstances under which it finds itself are not contemplated in the drill-book. The principles upon which those circumstances are to be combated *ARE* enunciated in the drill-book, it is the fault of the commander if he fails to apply them properly.

Pure standing gun drill, it is true, should be, and is, most rigidly laid down and no deviation from it should be allowed, because it must be the same under all circumstances, either with full or reduced numbers. By its means only can we attain and keep to a high state of "Discipline under Fire," but, beyond this mechanical function, much must be left to the judgment of Battery Commanders, in order to cultivate that individuality and power of initiative which is characteristic of a good commander in any station, and which is the only salvation when difficult and unforeseen circumstances arise.

By a rigid and uniform system of drill only can we ensure the correct performance of their duties by the *personnel* should their commander become disabled.

Freedom of action must not be looked upon as an excuse for the inception and practice of fancy methods of procedure, which are very often only the revival of exploded theories and should be most rigorously forbidden. The proper place for the development of these is at a School of Gunnery or with an experimental battery at a Practice Camp. It is highly subversive of good Fire Discipline for a commander, on assuming command, to find that his battery has been educated to act on principles that are unknown to him and are perhaps unsound. There is no desire to cramp inventive genius, but efficiency must be maintained at all hazards.

Summary.

To sum up, in answer to the problem, "Fire Discipline ; its necessity and the best means of securing it."

Fire Discipline, like the conjunction "que" of my motto, is the bond of union between (fire) arms and men, and is indispensable if the two are to act in unison.

To acquire it, everybody must know his duty thoroughly and confine himself thereto.

The Section Officers must really be the trainers and commanders of their sections and responsible for everything therein.

The Captain must be responsible for everything behind the line of guns.

The Battery Commander, standing on the windward flank of his battery, can then, by the intermediation of these four, administer and apply his fire in any desired manner. If his attention is diverted by looking after the performance of subordinates, which may very well happen if he has assumed too much of their responsibility during training, then, unless he be a man of exceptional powers, the fire of the battery will break down, or, at all events, not be administered to the best effect.

The onerous nature of his duty demands that he be relieved, as

much as possible, from all cares not immediately bearing on the administration of fire and, in the arrangement of drill, every facility must be given him, especially as regards the communication of his orders. To this end the introduction of a drill by signal has done much, in doubly enforcing to him the attention of the Section Officers.

More may perhaps yet be done, to arrive quickly at an effective fire by careful range-taking and preliminary reconnaissance, to increase the accuracy of fire by the higher training of layers and to ensure sustained accuracy by the application of mechanical means, such as clinometers, giving sustained uniformity of laying.

The administration of fire under the modern system has been stigmatised as a "one-man job;" but, if that man be as efficient as he should be surely the concentrated energy of his blow must be greater than that of several minor and dispersed efforts. That concentration can only be effected and upheld by Fire Discipline.

SKILL-AT-ARMS.

BY

LIEUT.-GENERAL SIR W. J. WILLIAMS, K.C.B.

In a paper published in the last October number of the "Proceedings," an attempt was made to show that military virtue is more important than skill-at-arms, that in our pursuit of skill-at-arms we are sacrificing much that tends to military virtue, that it is better to move a brigade division of batteries under one command than under three commands, and that our latest gun-drill is very unwarlike.

That military virtue is more important than skill-at-arms is not a proposition which will be accepted by officers who imagine that skill-at-arms will make the soldier shoot better in battle, or give him more self-confidence: they will argue forever that skill-at-arms is a considerable part of military virtue. The same objection, that skill-at-arms is a constituent of military virtue, can be raised against the second proposition. That it would be better to move a brigade division under one command than under three commands, if officers capable of moving the batteries together could be found, will not be disputed. The question is whether we have the officers. We have officers who say they could do it: we have officers who believe the officers who say they could do it: we have officers who write "No. Prince Kraft of Hohenlohe said they could not do it, therefore we do not believe you could do it, so we have put in your drill-book you are not to do it." Has any officer, who knows he can command a brigade division and place his line where he likes, ever said to any other officer, or confessed to himself, that batteries must move independently in battle? That our gun-drill is very unwarlike will not be allowed by the officers who make it. It it is not alleged that they designedly, to get good shooting at targets, make a gun-drill which they know to be unwarlike. The drill they have made is unwarlike, because they have been led away by what has been said and is being said, mostly, if not wholly, by ourselves, of the great advantage of hiding from the enemy; and because from want of knowledge, or of imagination, they have failed to distinguish between what is best for shooting at targets and what is good for discipline and war.

A very high authority, than who perhaps there is none higher, is reported to have said, in speaking of the magazine rifle, or of smokeless powder, or of both, "It is well known the soldier does not aim in battle." Our musketry officer, confident in his theory, and careless of

any authority against him, will say "Returns show the men shoot much better now: our system of instruction is so much improved: the men will aim in future battles." Our gunnery officer, if he has never watched firing with time fuzes after loss on coming into action or at the guns, nor looked over the laying of guns when the loss was severe, will say "Your high authority was not speaking of artillery," and will go back to his range reports and our letters translated from the German.

Perhaps, instead of making another attempt to show that skill-at-arms can have nothing to do with the military virtue of our people, that training them this way does more harm than good, and that it is better to move a brigade division under one command than under three, it may be of use to state nearly the same proposition differently, and to attempt some definitions and explanation. The proposition stated differently is Drill and discipline, and that some officers should be able to handle troops, are more important than skill-at-arms.

The phrase drill and discipline means drill which is of practical use and helps to make discipline. There are drills which help to make discipline and drills which have no such tendency. Among the drills which tend to discipline are the drills which make the appearance of the soldier mounted or dismounted; drills which fit him to take his place mounted or dismounted in the ranks; drills for the handling and use of his arms; parade movements and marching past, especially in brigade; field movements, especially in brigade, and if the meaning of the movement and the manner of it are true in tactics; firing with blank ammunition; and firing at targets. Marching past is supposed, by officers who do not understand, to be only for show; but, in artillery, parade movements make discipline, and teach batteries to move with smartness and accuracy. The widest manœuvre in artillery is changing position from quarter column to line; say, to line far to the right front and with your right forward when you get there, and that you have to clear your front without masking some other troops, and, moving as if before the enemy, you have to form line as soon as possible, and to get your line into position without inclining. If that manœuvre is badly done through the fault of the batteries, and not through the fault of the Commanding Officer, or of one or more Battery Commanders, the way to improve is not to repeat the manœuvre, nor to try simpler changes of position, but to go back to parade movements. Parade movements are drill for the men: field movements are drill for the officers, as manœuvres of opposing forces are drill for their commanders.

To handle troops means to move them well, two or the three Arms together, or any Arm in force or in brigade. There is the handling of personal command and leading; and there is the handling which is effected by giving the orders for the formation and movement of troops. In cavalry, there is handling in command of a regiment, and handling in the command of a brigade or a division, though personal command and leading does not go beyond the regiment or the line. The cavalry are fortunate. They have always about the best drill they can have. Our eclectic criticism of foreign military literature has not hurt them;

our peculiar idea of taking cover can hardly affect them ; they have not been devoted to skill-at-arms ; and the talk of devoting them to reconnaissance is idle. In artillery, a smart officer might get a single battery into action scathless where another officer would incur loss ; but, as a single battery ought to be always in line and is easily led, there is little handling until batteries are brigaded. If Horse and Field Artillery are not to become a disorderly collection of batteries, impeding other Arms and each other on the march and in battle, a brigade division must be personally commanded and led. The command is difficult, on account of the difficulty of making the voice heard in artillery, and the difficulty of leading a line of carriages at full interval square up to a position ; but an officer ought not to command Horse or Field Artillery unless he can handle them. We have no handling in infantry. There would be handling if we attacked in force ; but we shall not attack in force until we cease to extend for safety. Meanwhile, there is danger of the officers of our principal Arm forgetting how to name, or to know by name, the formation and movements of troops.

The plain meaning of skill-at-arms, in infantry and artillery, is such skill above the common in shooting at targets as may be acquired by much pactice. In a wider sense, some things we teach the soldier which have little to do with the serious business of fighting, and some drills and instructions which are not warlike nor disciplinary, are skill-at-arms. Such are signalling, range-finding, cycling, much of reconnaissance, mounted infantry, machine guns, Chap. V., Vol. II. of our drill-book, and the infantry attack.

Whether devoting our infantry and artillery to musketry and gunnery will cause them to shoot considerably better in future battles is a question upon which the experience of many senior officers must divide them from many of their juniors. That drill and discipline is more important than skill-at-arms ought to be allowed by all officers of regular troops. That handling troops is more important than musketry and gunnery will be understood only perhaps by officers who have some practical knowledge of manœuvre ; yet it seems not difficult to imagine that troops well handled might win where if not well handled they would be beaten, and that cruel loss may be incurred through inability to handle troops. There must be among us officers who can never forget seeing troops badly handled in battle.

Our gun-drill ought to be warlike, to tend to discipline, and not to name taking cover or hiding from the enemy. Nothing more irrational than putting taking cover into field drill ever grew upon an army. A sergeant now drills an extended squad on broken ground as if he were drilling for the Agricultural Hall. It is in the nature of men to find out for themselves, never a moment too late, more about cover than can be taught them at drill. An officer who has to move his command on a field of battle sees the safest way to go: only orders, or his talent and character, will make him go another way : education to take cover can have no effect but to annul his talent, when his talent and what he has been taught are opposed and his character is not strong enough to support his talent. It is the duty of Field Artillery

to come into action with regard to the position, or the line of advance, of other troops, and with especial regard to the close support of their own infantry and cavalry, and not with regard to cover: therefore, nothing can be worse than to teach artillery to come into action with muzzles just over the top of a hill. Officers ought to be exercised in showing artillery positions, always with regard to other troops. It would be better to incite some audacity of conception in attack than to inculcate caution.

In standing gun-drill, it is wrong to say that No. 1, ceasing to lay, may take the place of No. 3, fit fuzes, and continue to command; discipline is made inferior to gunnery. No. 1 must lay. It is difficult to say who ought to fit the fuze. A paper lately contributed by an officer of the Regiment to these "Proceedings" is perhaps the only trustworthy account of good practice made with time fuzes under fire. The story is that good shooting was made with two guns, somewhere in the south-east of Europe, by a lawyer who fitted his fuzes himself. We might make good shooting if we could afford to let the subaltern officers fit fuzes; but with us it is better for the officers to command their sections; so, unless No. 1 can do the duty, fitting fuzes to order must be left to the discretion of No. 3 and the chance of No. 1 correcting error. Silent drill is a dismal conception and a vain imagining. We may have silent drill; but in battle an officer will surely revert to the use of his voice, before or after he has tried futile signs.

Chap. V., Vol. II. of our drill-book, and the drill at our practice camp, have brought on us a partial paralysis. This affects us now at home. In war, we should throw away the bad things we have been learning, and then do our duty very well: that is most devoutly to be wished for. We may have learned to try more to find out by observation of our fire whether we have the right range. On the other hand, we should have to throw away all we have been taught about reconnaissance, range-finding by a non-commissioned officer with an instrument, preparatory position, and hiding and creeping. As there is danger of some of our officers, on their entering upon a campaign, being unable at once to free themselves from the effects of the bad teaching of years, it is advisable to proceed now to correct our drill, and to make our instructions not detrimental.

Our error seems to have begun when some clever officers with no practical knowledge took up the study of foreign military literature. But those officers could not have led us astray had it not been that the officers of Horse and Field Artillery who had practical knowledge were without reading, and, moreover, had left gunnery and the gun to be looked after by Shoeburyness. The source of much of our error is in foreign military literature; but the idea of drilling to take cover came to us from our infantry. It may have been evolved out of the inner consciousness of one of our officers who had not seen fire; or it may have been inspired by something he read. The artillery drill-book was evidently not a mine of learning and our officers who had practical knowledge did not seem inclined to see what might be learned from the study of the great events which had passed on the continent, when that study was taken up by clever officers who had ambition to distin-

guish themselves in that way. It is a pity they did not limit their serious reading to the official account of the French and German war, and that they did not strive to form their own opinions from the study of the best narrative and the German drill-books of the time; but they preferred reading less dry, and with their light reading took ready-made opinions. They have given an impulse to the Regiment; and they have taught us it is not safe to leave gunnery and the gun to be looked after by the Ordnance Select Committee and Shoeburyness.

The principal points of error in our new tactics are drilling to reconnoitre and to take the range, going into action independently by batteries, and halting in a preparatory position. In defence, artillery positions would always be reconnoitred, and ranges would be taken: in a first position of attack, some reconnaissance might generally be made by a Commanding Officer, and would be made if it were advisable to make it: to the nearer positions of attack batteries would almost always advance without reconnaissance. We make a great mistake in drilling for the first two cases instead of for the last. We ought to drill to come into action by brigade divisions, without reconnaissance, against something not seen from where we start. That would be drill in handling for the Commanding Officer and drill in gunnery for the Commanding Officer and his command. As often as not, the drill ought to be for the Commanding Officer to lead his batteries up to the position, and for the Battery Commanders to find their targets independently. Our range-finding is skill-at-arms for domestic use only. It is not possible to believe that any officer who has seen the proceeding can think it warlke; nor possible to believe that any officer will maintain that it would be right in war for the Commander of a brigade division or of a battery to put any faith in a report of range found by a non-commissioned officer. All Field Artillery officers ought to be trained to judge distance across country. Moving independently by batteries is not of the genius of Field Artillery: Field Artillery is organised by batteries, and manœuvres by brigade divisions Halting in a preparatory position is contrary to a first principle in tactics.

Considering the state we are in, and the state to which we might come, it is advisable to look for immediate security against irrational change, and then to proceed with deliberation to amend our faults.

We could find our defence in a standing committee composed of the General Officer Commanding Artillery at Aldershot, the General Officer Commanding Woolwich District, if he had held a command of Horse or Field Artillery, and the Deputy-Adjutant-General, Royal Artillery, at the Horse Guards, if he was in like manner qualified. The correspondence of the General Officer Commanding Artillery at Aldershot must pass through the General Officer Commanding the Division; but the Commander of the Artillery at Aldershot ought to be on the committee because he is most in touch with Horse and Field Artillery, has most means of making trials, and sees most of field movements of all Arms. The committee would take cognisance of every proposal of change in Field Artillery material, drill, or tactics. Their recommendation would carry great weight. Their adverse opinion would not be an absolute veto: the officer making the proposal could appeal to the Commander-in-Chief.

The committee, being established as an immediate safeguard against irrational change, might then proceed to review our whole situation, in order to see what recommendations of their own they could submit. There is much waiting to be done. In material, it would be their duty to get the 12-pounder made a proper field gun by being made more effective at short ranges; and to get a proper gun for those batteries of Horse Artillery that are to be brigaded with Cavalry. They ought to consider the whole question of ammunition with regard to battle and short ranges; what reliance can justly be placed on time fuzes in battle; whether we have enough case; whether we ought to have common shell to burst and carry destruction instead of the dummy shell we have; whether we ought to have some segment shell; whether it would not be better to have more common shell, or more common and segment shell together than shrapnel; whether we ought to have any shrapnel; and whether it is not of more importance than anything else to have proper common shell, or segment shell, that will burst with percussion fuze at all ranges from the range of case. They ought to get it forbidden by order to pass a cart horse into Horse or Field Artillery. They might consider the question of pole-draught. In drill, they might give us a new brigade drill, up to our present knowledge of drill, and legitimating the gallop of Field Artillery in field movements. In tactics, divesting their minds of the idea of hiding from the enemy, and not making a selection from foreign Regulation and literature, they might re-write Chapter V., Volume II., and make it much shorter by not putting in anything not wanted. They might especially consider whether it is advisable to add to our plan of interchanging the gun and wagon-limbers of guns in action any scheme for the supply of ammunition in a first position; whether, in war, any advantage would be gained if the guns could be made more ready to advance; what advantage would be gained by sending away the gun-limbers to the line of wagons; and whether any advantage of readiness to advance which might be gained would not be counterbalanced or outweighed by the disadvantage of filling up the intervals, making Nos. 4 cross the intervals and have further to go, bringing up more carriages on coming into action, and making more work in the battery.

GUERNSEY,
13th June, 1892.

MOUNTAIN ARTILLERY PROGRESS.

BY

MAJOR H. C. C. D. SIMPSON, R.A.

The last five years have seen great advances made in the organisation and equipment of Mountain Artilleries of Continental nations.

Indeed, for mountain warfare generally, Austria, France, and Italy have specially constituted tactical units, such as Mountain Divisions, Brigades, or Groups. In the Mountain Divisions, in addition to the Mountain Batteries, two or three Horse or Field Batteries are attached as a reserve.

The Mountain Brigade usually consists of two or three regiments of infantry, some technical troops, and a half troop of cavalry. The Group has less infantry and no cavalry. In European mountain warfare these two smaller units really play an analagous *rôle* to the Cavalry Brigade of ordinary warfare. They reconnoitre all the mountain paths, ascertaining the movements and lines of advance of the enemy's troops, whilst concealing the operations of their own main body in rear.

France, which had, up to the commencement of the period we have stated above, no permanently organised Mountain Batteries on her home establishments, has now 13 batteries of six guns on a peace footing, in addition to the eight batteries she maintains in Algeria.

The minor Balkan States have all formed a Mountain Artillery. Austria has recently re-organised her Mountain Artillery, and Italy increased hers by two batteries of natives, both for service in Africa. Russia has the largest Mountain Artillery numerically—25 batteries—but has by no means the most efficient.

The following table shows the number of mountain guns belonging to European nations early in 1892 :—

NUMBER OF MOUNTAIN GUNS OF EUROPE, 1892.

France (including Algeria)	126
Russia	120
Turkey	96
Spain	72
Austria	60
England (including 8 batteries British in Indies) ...	60
Italy	54
Greece	54
Portugal	16
Roumania	16
Switzerland	12
Norway and Sweden	12
Total	698

Apart from the re-organisation in 1889 of the Mountain Artillery as a distinct branch, perhaps the most important event with us is the publication recently of the first "Manual of Mountain Artillery Drill" ever issued in England.

It is interesting to note a military treatise, lately published in France for the guidance of her Mountain Artillery, entitled "Instructions sur le Service de Guerre de l'Artillerie de Montagne." Recognising the usual conditions under which mountain warfare has frequently to be conducted, that is by small columns acting more or less independently along different paths in échelon, with single Mountain Batteries in each column, the instructions laid down for their Mountain Artillery deal with the "Battery" as the sole tactical artillery unit, not the "Brigade Division."

A few of its instructions are here detailed.

"The position of a Mountain Battery in the column when there is a probability of being attacked should never be too far to the front, as, if exposed suddenly to a heavy fire, it is not only without defence in itself, but liable to suddenly lose its means of action, as it is sufficient for one of its ordnance mules carrying a component part of gun or carriage to be wounded and fall over a precipice, to deprive it of the use of one of its pieces. Its place in the "Group" should be after the second company of the main body if the advanced guard consists of only one company, or after the first company if only two companies are in the advanced guard. That is, its natural place is between the companies whose duty it is to take part in the reconnoitring engagement and fighting in front, and those which are to carry out the attack on the position or act as a reserve. Its formation of march is 'Column of Route' (single file) or 'Column of Sections.'

It must, however, be sufficiently far to the front in the main body to be able to come into action as soon as the advanced guard is engaged, in order to prevent the enemy's artillery from coming into action, and to protect the deployment of its own infantry."

"A battery ought never to be broken up unless under exceptional circumstances, such as there being insufficient space in the position for the guns in line. In such cases the Section Commanders should keep up communication with the Battery Commander, who directs the fire generally. This breaking up of the battery does not refer to small isolated columns to which sections only may be permanently attached."

"Placed in its first position sufficiently far to the front to support the troops with which it is co-operating, without endangering a rush on the guns, any further change of position, excepting for the critical moment of pursuit or retreat, should not be made without some very strong reason. The relative slowness of the movements of Mountain Artillery, the nature of the roads, and the length of its column render changes of position frequently long and difficult. It should always be borne in mind that in mountainous countries, in order to get nearer the objective by some hundreds of yards, one may have to traverse some miles, during which the enemy are profiting by the cessation of fire. If a second position should be necessary, the Battery Com-

mander should first assure himself that he can reach it in time to carry out his idea, and without the liability of experiencing heavy loss, and so placing the battery at a disadvantage to the enemy's artillery, or even infantry."

Prior to coming into action, the battery is divided into two lines, the "Batterie de Tir" corresponding to our fighting line, including the six guns and twelve ammunition mules, and the "Echelon de Combat" corresponding to our ammunition line and artificers line, comprising the remaining ammunition mules and spare material mules of the battery. The supply of ammunition is kept up as follows:—In action the boxes of the first ammunition mules are unloaded and placed in rear of the guns, or if the ground permits in rear of the flanks of the battery. The non-commissioned officer in charge of the second ammunition mules places them under cover in the position indicated. The unloaded 1st ammunition mules are put under cover by the N.-C.O.'s of odd sub-divisions of each section. When the whole of the 1st line mules are under cover, the Quartermaster-Sergeant, who is in charge of the "Echelon de Combat," and has conformed to the movements of the "Batterie de Tir," at a distance in rear of from 300 to 400 yards, now selects a position under cover, from which the nature of the path to the fighting line will enable the ammunition mules to arrive in relief of the empty box mules within five minutes of quitting the "Echelon de Combat." When in position he tells off the six ammunition mules held first in readiness to proceed with a N.-C.O. to the fighting line when required.

The first ammunition boxes when unloaded, have their contents distributed by the N.-C.O. in charge to the ammunition numbers of the gun detachment, and as soon as the contents of three pairs of boxes have been fired away three of the second ammunition mules are sent up to the front, their boxes taken off, and re-loaded with empty boxes they are sent back to their position under cover. The boxes of the odd sub-divisions are emptied and fired away first. The relief in the fighting line is, therefore, by three mules at a time, so that there are never more than three or six mules in rear of the guns at the same time under fire.

The supply to the fighting line from the "Echelon de Combat" in rear of ammunition is maintained thus. When the first shot is fired, the Q.-M.-S. sends up six ammunition mules to the position under cover where are the first and second ammunition mules. As soon as the six first ammunition mules, laden with empty boxes, have returned from the guns under cover to the second ammunition mules, the N.-C.O. in charge at this spot sends them back to the "Echelon de Combat" (ammunition line) with a gunner or junior N.-C.O., and they are replaced by six other ammunition mules. The supply of ammunition between the battery and the ammunition line is thus by six mules at a time. The reserve ammunition columns if in the neighbourhood replaces by six or twelve mules at a time the deficient ammunition of the "Echelon de Combat."

I have gone into this rather fully, as, except in the briefest manner in the new manual, no instructions are laid down on this important

point for the instruction of our Mountain Artillery, and I have never seen a regular system practised.

In the last war, the wretched ballistic powers of the Russian 1867 pattern mountain gun, as we have seen, rendered the co-operation of the Mountain Artillery of slight account in many of the operations. The 1883 pattern gun is an improvement. It has been described in the "Proceedings," so it is only necessary to give a few diagrams (Plate I.) of the equipments in pack. The pack saddlery would appear to be a varied assortment on quite different lines to our own.

Several novelties in the way of mountain ordnance have been proposed for adoption by various Foreign Powers in the last year, of which, perhaps, the following are the most interesting :—

(I.) The Q.F. 2½-pr. gun, under consideration in Italy for a portion of her Mountain Batteries employed in the defence of her Alpine Passes ; and

(II.) The system of jointed guns with homogeneous A tube, proposed by Colonel Lycoudis for introduction into the Greek Mountain Artillery.

(I.) Preferring the rapid fire at a critical moment of a high velocity small shell gun to the low velocity but larger calibre ordinary shell gun of the French, the Italian Government are experimenting with the 2½-pr. Q.F. gun of Maxim-Nordenfelt Company.

The gun is an ordinary steel quick-firing gun of 1·65-inch calibre, 60·5-inches long, and weighs 195 lbs., constituting one mule load. The cradle has to be raised very high above the back of the mule, to prevent the muzzle touching the croup of the mule, over which it projects, and thus offers a most inconvenient load for turning sharp corners, &c. The carriage, of steel and iron forgings, is of the following weights and dimensions :—

(*a*.)	Trail, with elevating and traversing gear, 176 lbs. (top load).		
(*b*.)	Cross head	43 lbs.	114 lbs. (top load).
(*c*.)	Break gear	22 "	
(*d*.)	Axle	49 "	
(*e*.)	Wheels	152 "	208 lbs. (wheels, side load).
(*f*.)	Shield	56 "	(shield, top load).

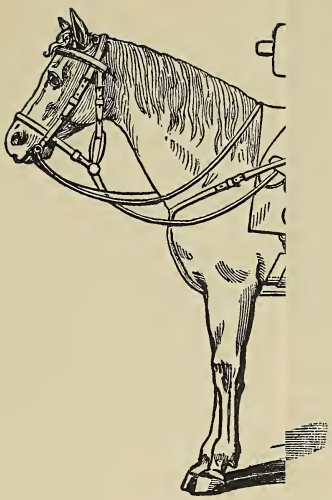
(*a*) constitutes one mule load, (*b*), (*c*), and (*d*) a second mule load, and (*e*) and (*f*) a third mule load.

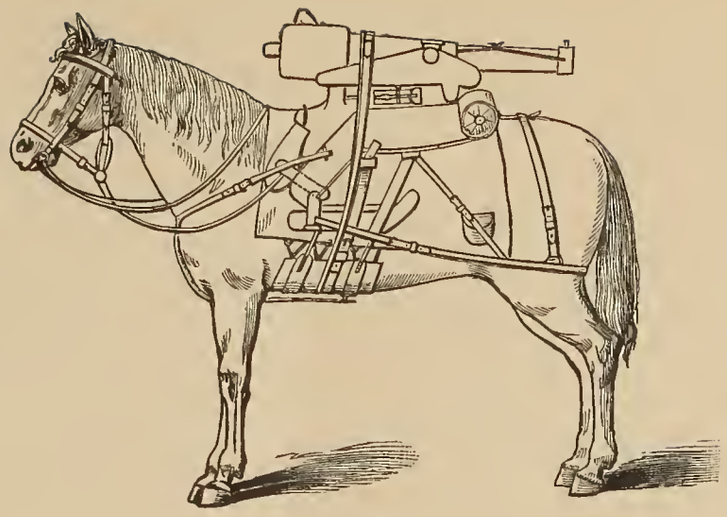
The ammunition is "fixed."

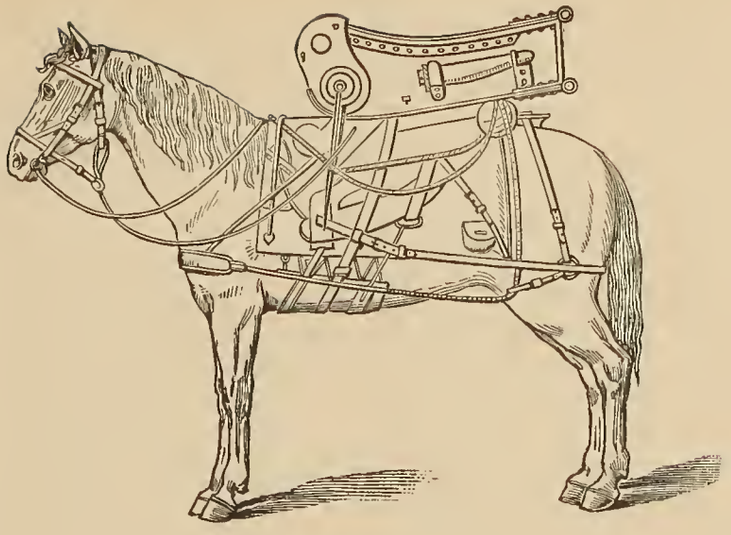
There are three projectiles, ring and shrapnel shell, 2½ lbs. each, and case shot, 2¾ lbs.

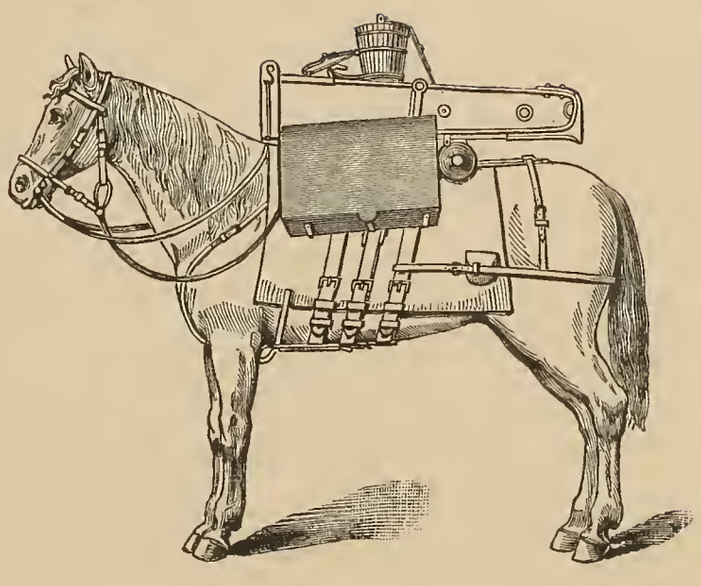
The full charge is 9½ ozs. R.L.G.^{4} powder, giving a muzzle velocity of 1450 feet. The fuzes employed are the "Point percussion" and "Time and percussion." The limit of effective fire is 3500 yards.

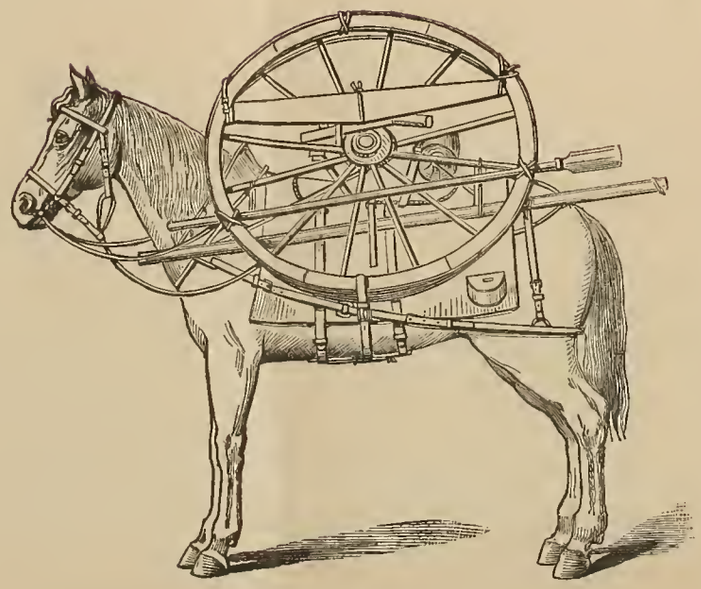
(II.) Commandant Lycoudis, a Greek military engineer, has devised for mule transport three mountain jointed pieces, corresponding in ballistic power, respectively, to the 75^{mm} field gun, the 87^{mm} field howitzer, and 120^{mm} field mortar of Krupp, requiring each, with the exception of the latter, which necessitates an additional mule for

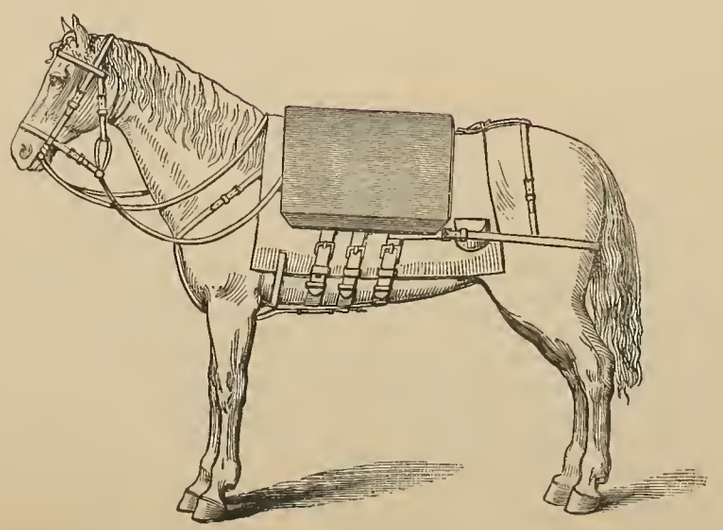


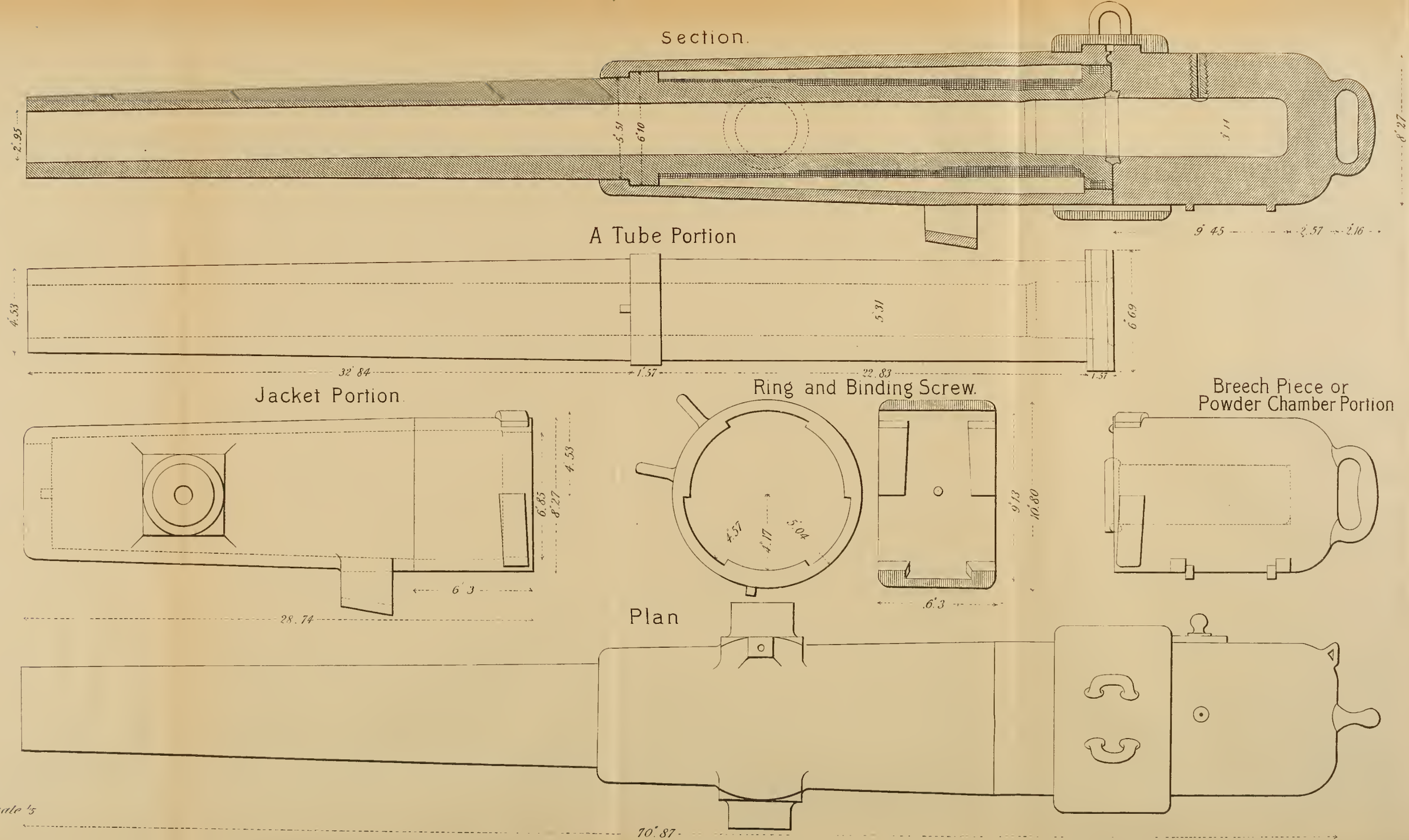


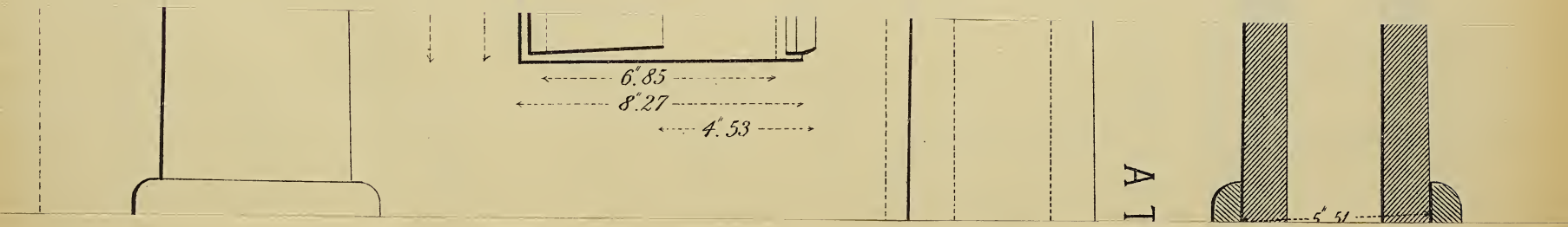









Section.
2'.95
5'.31
6'.10
3'.11
8'.27
9'.45
2'.57
2'.16
A Tube Portion
4'.53
5'.31
6'.69
32'.84
1'.57
22.83
1'.57
Jacket Portion.
6'.85
8'.27
4'.53
6'.3
28.74
Ring and Binding Screw.
4'.57
4'.17
5'.04
9'.13
10'.80
6'.3
Breech Piece or
Powder Chamber Portion
Plan
Scale 1/5
70'.87


6".85
8".27
4".53
A T
5".51

transport of the carriage, three mules for transport of piece, and three for carriage complete.

It is only necessary to describe the gun, as it is, perhaps, the most practical of the three, which are alike in principle. (Plate II.)

The gun, of three separate loads, consists of A tube, 230 lbs.; jacket and binding screw, 152 lbs.; and the breech-piece or powder chamber and hermetically-closing outer ring, 195 lbs.

The A tube is of steel, rifled, 58·75 inches in length, and fits longitudinally into the outer jacket which reaches rather less than half the length of the former, the surfaces of contact being conic, by which arrangement of longitudinal instead of transverse combination, the junction of the component parts does not affect or interfere with the rifling, which is continuous from breech to muzzle. The powder chamber (157 lbs.) is joined transversely behind the longitudinal divisions by a screw and hermetically closing outer ring (38 lbs.), which completes the piece (577 lbs.) The total length of the gun is 70·42 inches. Its service powder charge and projectiles (9½ lbs.) are the same as for the field gun of the same calibre, 75^{mm}, its initial velocity being also identical, 1530 f.s. It is impossible to pass an opinion on such a gun without some information as to the result of any practice trials. But, as in the Q.F. gun already described, the length of A tube exceeds the proper length of such for a mule load, the maximum for which should *not exceed* 54 inches.

We have yet to provide a satisfactory successor to our 2·5-inch jointed gun, as the 20-pr. jointed howitzer is far too cumbersome an equipment to become a general service mountain gun. Indeed, apart from its other numerous disadvantages, the advantages of a howitzer under any circumstances would seem to be much exaggerated. None of the Continental Powers have adopted it, and, although it may be said that they all have low velocity guns, this is alone owing to their aversion hitherto, to introducing, for mountain service, a jointed gun of any description. However, the experiences of our jointed gun have not been lost on more than one Foreign Power. Without going over all the well-worn arguments, our present gun is of too small a calibre, and, bearing in mind this fact, and the advantage already mentioned of interchangeability of ammunition with our Horse Artillery gun, it really seems as if a 12-pr. B.L. gun should be our mountain gun for the future.

Most Mountain Artillerists are agreed that we should not exceed the number of portions of our present gun, and, as regards the question of the number of ammunition mules in a battery, I think it may be accepted as a principle, that the number of mules required to transport the ammunition of a sub-division, should not exceed the number of rounds that one mule may carry. 100 rounds is considered the proper proportion per sub-division. One mule could carry 10 rounds of 12-pr. ammunition, or 10 mules the amount for a sub-division. This would necessitate an increase of 24 mules to our present battery establishments. Not excessive. The weights of the gun must not exceed 4½ cwt., viz. :—210 lbs. each gun portion, and 84 lbs. the breech-closing arrangement. What is the minimum muzzle

velocity which a mountain gun should have? Recognising the principle that in the larger valleys Mountain Artillery may be opposed by Horse Artillery, the gun must have the velocity of the Horse Artillery gun of a possible foe. The initial velocity of the present Russian Horse Artillery gun is 1350 f.s. This is surely a high enough velocity for our proposed 12-pr. mountain gun. It is advantageous to be able to avail ourselves of high angle fire, we must, therefore, as in the Russian mountain gun, have two service charges. Not to increase the number of mules for the transport of our gun and carriage, I would arrange the loads in this manner. Two mules for the muzzle and breech portions; two mules for carriage complete without wheels; one mule for the wheels and breech-closing arrangement (on top). One of the ammunition mules, instead of carrying as the other nine, three rounds of shrapnel and two of common in each box of the pair, should be brought into the 1st line and carry six rounds of case shot and the contents of the present small store boxes. This would still give a total of 96 rounds per sub-division—the minimum. Can the manufacturing departments produce such an equipment fulfilling these conditions, viz.:—A 12-pr. B.L. gun of 4½ cwt., mounted on a carriage complete of 5 cwt., with a muzzle velocity of 1350 f.s.? The French 12-pr. mountain gun of 221 lbs. has a muzzle velocity of 850 f.s.

A gun, about a 12-pr., but of greater weight, manufactured by a private firm, was experimented with last year (1891) at Hay, but its velocity was considered too low, though shooting generally was satisfactory.

It would be interesting to many officers were an account of the experiments carried out at the Mountain Artillery Practice Camp at Hay, with mountain equipment, published annually in the "Proceedings."

ACHIEVEMENTS OF FIELD ARTILLERY.

BY

MAJOR E. S. MAY, R.A.

PART II.—Chapter II.

The Era of Napoleon.

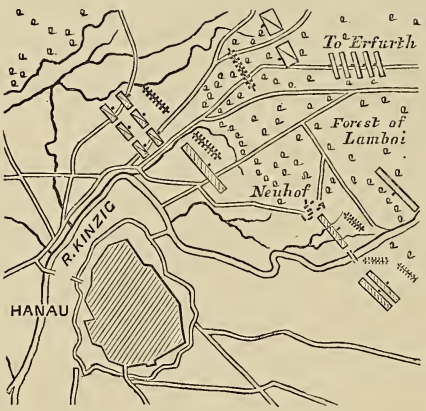
In the two days' battle of Dresden, August 26th and 27th, 1813, the artillery, especially that of the French, played a prominent part, and during the second day a large share of the fighting fell to it. From the Memoirs of General Marbôt an incident which we imagine to be unique in the annals of war may perhaps be noted in these pages, although it is rather curious than valuable to us.

Heavy rain fell during the second day of the great battle, and the muskets of the infantry were in many cases rendered useless by the wet. A division of French Cuirassiers found itself opposed to a strong Austrian division of infantry formed up in square to receive them. The General at its head called on the division to surrender, and drew the attention of its leader to the fact that not a musket of his command could fire a shot. The Austrian retorted that he was more than a match for the horsemen with his bayonets alone. "Then I will mow you down with my artillery" replied the Frenchman. "You have none, for they are all stuck fast in the mud!" "But, if I show you the guns in rear of my leading regiment, will you surrender?" "Certainly, for we should have no means of defending ourselves." After this extraordinary altercation the French General brought up a battery of six guns to within thirty paces of the square, the gunners laid the guns upon it, and stood with lighted portfires ready to open fire; and then, the requirements of honour being, we presume, satisfied, the Austrian General and his division laid down their arms!

The rain had so much interfered with the movements of the cavalry, and had, as we have seen, so greatly paralysed the fighting powers of the infantry that, according to Marbôt, to the artillery fell the principal *rôle* in that day's battle, although their mobility was much circumscribed owing to the condition of the ground. Napoleon, ever fertile in resources, however overcame this difficulty, and enabled his guns to do particularly good service by doubling their teams from the Commissariat wagons which were in the town; and, as Marbot says, "*Aussi nos pièces de campagne firent-elles un grand ravage, et ce fut un de leurs boulets qui frappa Moreau.*"

A more legitimate artillery achievement which we shall take from the wars of this epoch forms the chief interest of the battle of Hanau, an action which is memorable because it was the last of the vast succession fought in Germany during the wars which succeeded the French revolution. Napoleon having been defeated by the Allies at Leipzig in the autumn of 1813, was hurrying, with the remains of his shattered army, to the French frontier. The Bavarians, encouraged by the prospect of freeing Europe from the heavy hand of the tyrant, opened up by the strong coalition which had declared against him, suddenly deserted his banners, joined the Allies on the 8th of October, and now stood as enemies across his line of retreat homewards. On the 29th of October Marshal Wrede had taken position in the forest of Hanau, stationing his troops across the great road to Mayence, and thus effectually blocking the French line of retreat. The force under his command numbered some 50,000 men.

BATTLE OF HANAU.—30th October, 1813.



Napoleon, who had left Erfurth with 90,000 men, had lost so many men on the road, owing to straggling, sickness, and the other causes which ever attend the retreat by forced marches of an army more or less demoralised by defeat, and suffering considerably from the privations incidental to it, that he now found himself with even nominally but 80,000 men, and of these 30,000 had dropped so far back along the road that they were not available to take part in the fighting which was imminent. He had lost heavily in artillery, too, during his recent reverses, and his magnificent force of 1300 guns had now become reduced to 200. The majority of these, however, belonged to the Guard, and were equal to any in Europe. The forces available on either side were therefore not unequally matched. For whatever want of *morale* may have existed in the French ranks was counteracted by the knowledge that they were fighting to gain their road home, and that they must break their way through their enemy or perish.

The Emperor no sooner heard that the Bavarians blocked his path than he made dispositions to attack.

The allied army stood in front of Hanau, the right wing resting on

the Kinzig, the left in echelon on the road from Erfurth to Frankfort. Their centre was garnished with a mass of 60 powerful guns, which were placed so as to sweep the line of advance of the French as they debouched from the forest. Thus it seemed that the feat of Moreau at Hohenlinden might be repeated, and if Wrede were strong enough to prevent his opponents from deploying as they emerged from the issues of the wood, he might emulate the achievement of the great soldier who had just fallen at Dresden. But the conditions were scarcely similar, even leaving out of sight the fact that the resources of a brilliant military genius had to be reckoned with.

The corps of Victor and MacDonald, pushing the advanced light troops of the Bavarians with some difficulty through the wood before them, at length gained a footing beyond the trees and endeavoured to deploy. They had suffered heavily in the recent disastrous engagements in which they had taken part, and weary and dispirited as they were they now came under a most trying cannonade from the great mass of guns which stood before the allied line, and which poured a heavy concentrated fire upon them. For four hours the French army was unable to make any way across the narrow plain which lay between the forest and the banks of Kinzig. Napoleon's anxiety for the safety of his line of retreat grew as the hours went by. Finally he sent the trusty Druôt, who had served him so well at Wagram and Lützen with his artillery, to examine the enemy's position, and he returned to say that with 50 guns and two battalions of the Guard he would engage to force a passage. The "Immortals,"[1] as the rest of the army termed them, had suffered less than the other troops during the late battles, and was still comparatively intact and in good heart. The Emperor yielded to his suggestions. Two battalions of the Guard which had just come up were sent forward in skirmishing order, and succeeded in clearing the enemy's tirailleurs from the outlets of the forests and the little plain beyond. In their wake Druôt led forward his great battery. He first brought but 15 guns into action, but gradually added to their number until all his force was deployed. The Artillery of the Guard was, as we have said, splendidly equipped and trained, and their well served fire, directed by an exceptionally able leader, soon got the better of the guns which opposed them, and in a little while established a marked superiority over them in spite of the preponderance in numbers which they possessed. Then Nansouty and Sebastiani debouched with the cavalry of the Guard under cover of their fire, and launched their squadrons, which were also comparatively little the worse for their recent experiences, upon the enemy. These justly dreaded horsemen swept away all in their immediate front, and when Wrede threw some of his force into squares and tried to reorganise his cavalry in the rear for another effort, Druôt's irresistible batteries were again ready to paralyse all their efforts to rally, and the Russian cavalry, which attempted to come to the support of the infantry, were as little able to withstand the French Curassiers as they had been. Finally the whole left wing of the Allies gave way entirely and fled headlong towards the Kinzig, leaving the

[1] Because the Emperor towards the close of his career was extremely chary of putting them into action.

path of escape open to the French. The Bavarian General made a last and despairing effort on his right, but two battalions of the old Guard were available to be sent against him, and were strong enough to bring his advance to a stand-still. Finally Wrede was compelled to give up all hope of cutting off his great antagonist, and was glad to find security for his shattered army under the cannon of Hanau.

Thus a General who appreciated the power of artillery was able once more to bring victory round to his side by a judicious yet bold handling of the arm, and Hanau undoubtedly may be quoted to illustrate what guns thrown with prompt decision into the battle are capable of effecting.

We might well wind up the era of Napoleon with this incident from a battle not as widely celebrated as many, but which must yet ever interest artillerymen on account of the part played in it by their arm, but ere we close this portion of our subject it may be right to notice the effect which was produced at Waterloo by the great battery of 76 guns which prepared the way for the attack of D'Erlon's corps on the British left centre. All accounts of the battle have borne eloquent testimony to the terribly destructive effect of these guns, and their performances deserve mention, because assuredly it was not owing to any lack on the part of their artillery that the attack of the French was repulsed. Great, however, as was the execution they did, it can hardly be said that they exerted a decisive effect on even a phase of the battle, because the attack they immediately supported failed, and we would here only speak of feats performed by guns such as left an unmistakeable trace behind them on the fortunes of the day. It may also excite surprise that nothing has been brought forward from the great struggle in the Peninsula, of which the artillery are as justly proud as any of their comrades of the other arms, in pages which are written to recount the achievements of guns. The truth is that, although the support given by batteries was often most opportune and valuable, the history of that campaign does not furnish us, except in one instance, with any brilliant strokes effected by them such as are sufficiently memorable to be recorded in the same category with those with which we have just dealt.

Artillery is an expensive force to equip, requires time to train, and is especially vulnerable as regards its mobility in action. Just as the great British leader was obliged by administrative and economical considerations, and the relation in which he was placed with regard to the Government at home, to spare his cavalry as much as possible, and refrain often from throwing it into the scale, even when it was most evident that decisive result could only thus be reaped, so it was with the other mounted arm, in which he was weak, and which he felt he could not afford to risk.

Just for the same reasons that the pursuit was never vigorously pressed by Wellington, it was that his guns were not handled in the bold and independent manner which, if it endangers their safety, at least assures that of the other arms, and most often leads to decisive success. A military despot with the whole resources of the State at his back may hazard strokes which a General whose minutest actions

may be criticised and pulled to pieces by an assembly of civilians confident and inexperienced dare not incur.

One feat of the arm of the Peninsula days is, however, widely celebrated, that, namely, which Norman Ramsay's troop performed at Fuentes d'Onore, and this unfortunately seems quite out of place in a discussion of this kind. As has been well said, *"L'artillerie n'a qu' une tactique—le feu."*[1] What lies outside the sphere of fire, be it batteries charging cavalry, or gunners, as in another celebrated instance, imitating that arm, may fascinate us by its magnificence, but is not war. Therefore a splendid piece of daring is omitted from this record, although it is justly dear to the Regiment, and deserves to be cherished as an instance of what a quick eye and instant decision may accomplish.[2]

Small isolated cases, too, where a few guns, or even a single battery, have been equal to some difficult occasion, or have attracted notice by their soldierlike conduct, have also been left out of an account which does not pretend to be exhaustive, and which aspires to cover an immense period of time. It may be mentioned, however, that when Pakenham's division at Salamanca fell on Thomière's flank and struck the decisive blow of the day, the fire of the 12 guns which accompanied it was most effective, and went far to bring about the destruction of the French. Admirably placed in a commanding position on the flank of the enemy's column, they suddenly took their enemy in his weakest point, just as Blucher's guns at Bautzen surprised Ney, and assisted materially in driving home a success which developed into a brilliant victory.

Shortly after this battle, during the cavalry action at Ribera, on the 24th July, 1812, when General Long's force defeated the French under General Lallemand, "D" Troop, R.H.A., so highly distinguished itself that during a subsequent truce the French leader took the opportunity to send the following message to Captain Whinyates[3]:—"Tell that brave man that if it had not been for him I should have beaten your cavalry, but that, meeting me in every movement with his fire, he never would allow me to form for attack. Say that I shall mention his name in my orders as having been the cause of our defeat, and not your cavalry. Be sure to tell him this. Promise to give him my message." To be mentioned in your foe's despatches is perhaps a higher tribute than to find a place in those of your own side, and the performance must have been brilliant which called forth so chivalrous a message.

In Colonel Whinyates' history[4] of "C" Battery, R.H.A., from which the foregoing incident has been taken, an example of effective action on the part of a small number of guns is also to be found which deserves again to be recalled to memory.

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[1] de Heusch.

[2] It is to be noted, however, that it is extremely doubtful whether the feat of Norman Ramsay was on as large a scale as is usually supposed, and that it is not by any means certain that more than a portion of a troop took part in it.

[3] Afterwards Sir E. C. Whinyates, Commandant of Woolwich Garrison.

[4] *See* "From Corunna to Sevastopol." The History of "C" Battery "A" Brigade. By Colonel F. A. Whinyates, formerly Commanding the Battery.

At the battle of Albuera, 16th May, 1811, the "most sanguinary and awful combat that has been fought in the Peninsula," "D" Troop,[1] which consisted of only four guns, was in the very thick of the *melée*; and though the guns were repeatedly charged or ridden through by the French cavalry, their attack was checked at a most critical part of the battle by the effective fire which they brought to bear.

Marshal Beresford, in his despatch, says—"The four guns of the Horse Artillery, commanded by Captain Lefebure" (with whom also was Captain Whinyates) "did great execution on the enemy's cavalry."

It is thus that Brigadier-General R. B. Long,[2] in a letter dated the 26th June, 1811, from the bivouac near Vicente, speaks of the services of this troop, "D." "The dispersion of our cavalry scarcely left us 400 or 500 British at any point, and these, with two regiments of Spaniards, were all we had to offer by way of resistance to their numerous and overwhelming columns. The ground, however, favoured us, and the Horse Artillery did its duty with brilliant effect. The enemy lost a great number of men, and from 400 to 500 horses, *by the operation of this arm alone!*"

Nor can we leave unnoticed the part played by the artillery at Vittoria, the only triumph of the arm during the war, and the battle most decisive in its results of any which our army gained in Spain—even if no deeds that fascinate the imagination, such as the giant blows of Senarmont or Lauriston, can be recorded from that fight. It has been whispered that the Duke of Wellington did not understand artillery tactics thoroughly, and failed somewhat to appreciate how the arm might best be turned to account. It is at any rate certain that we do not find guns employed in masses during the Peninsular campaigns except at this battle—a fact, however, which we are rather inclined to attribute to the causes which we have already mentioned than to any tactical prejudices of the Duke's. It is, however, an odd coincidence that in the battle where our batteries most distinguished themselves, and where their effect was due to the manner in which they were employed in masses, their concentration was due rather to good fortune than good guidance on his part, just as had been the case with Daun at Torgau.

"The nature of the country,[3] and want of roads, was the means of throwing a large proportion of our artillery together, away from their divisions, which I availed myself of, and by employing them in masses it had a famous effect. This was adjoining the great road to Vittoria; and the French brought all the artillery they could to oppose our advance, so that the cannonade on one spot was very vigorous. In none of our Peninsular battles have we ever brought so much cannon into play; and it was so well directed that the French were generally obliged to retire ere the infantry could get at them. There were few or no instances of the bayonet being used during the day."

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[1] "D" Troop had only four guns at Albuera, the other two being still dismounted at Lisbon. It may be as well to remind our readers also that this Troop, which was reduced in 1816, is in no way connected with the battery which at present bears the same letter.

[2] Commanding the brigade of cavalry to which "C" Troop was attached.

[3] *See* a letter from Colonel Dickson quoted in Duncan's "History of the Royal Artillery," Vol. II.

Without attempting a full account of this great battle, or of the events which led up to it, we may tell how the French, under Joseph Buonaparte, retreating from Burgos before Wellington, found themselves on the 21st of June, 1813, in the low lying ground which forms a sort of basin in front of Vittoria, with immense convoys of baggage, warlike stores, treasure, and works of art, the spoil of Spain, and with but one road fit for the retreat of an army so encumbered as was theirs in their rear, and with their right menaced by a part of the allied forces under Sir Thomas Graham.

Wellington determined to assail the enemy in three different attacks. Sir Thomas Graham with 20,000 men and 18 guns was to attack their right and endeavour to cross the Zadora at Gamara Mayor and Ariaga, and thus cut their line of retreat.

Hill, with 20,000 men, was to cross the river at Puebla and threaten the enemy's left, and Wellington himself, with 30,000 men and the great mass of the guns, was to attack the enemy's centre by the bridges of Mendoza, Tres Puentes, Villodas, and Nanclares.

BATTLE OF VITTORIA.—21st June, 1813.

At 1 o'clock Hill had gained the village of Subijana in front of the enemy's left, and the smoke of Graham's guns seen up the valley of the river showed that he too had launched his men to the attack. The Allied centre attack had reached the various bridges it was to cross by, and was engaged with the enemy in desultory combats, waiting till the moment for a decisive advance was ripe.

The King, anxious for the safety of his line of retreat, now com-

menced to move his reserve to the rear, and was contemplating a general withdrawal when the 3rd and 7th Divisions of the Allied force made a rush on the bridge at Mendoza and crossed the river, while the light division moved from Villodas to Tres Puentes, and crossing there took the advanced French post in rear, and the French were forced to take up a position on the heights before Arinez. The 4th Division, under General Cole, also advanced from the bridge at Nanclares, joined in the attack of the left wing, and the heavy cavalry, also passing the river, filled the interval between Cole and Hill.

When the French were thus caught in the midst of their dispositions for retreat, they threw out a great battery of 50 guns which, supported by crowds of skirmishers, gave breathing time to their hard pressed comrades by the effective and active fire which they kept up on the advancing enemy. Then the first great artillery duel of this battle, rich in artillery achievements, commenced, for Wellington called to his assistance several brigades of British guns, and the front of both armies was soon shrouded in the dense smoke of the contending artilleries. During this contest the French gradually drew off their troops to a second position in front of Gomecha, where they had posted their reserve, but their rear-guard still clung to the village of Arinez, and held back the rising tide of the Allied onset.

But Picton's and Kempt's brigades after severe fighting succeeded in carrying the village, and the 7th Division on their left, and the 4th on their right were soon also triumphantly forcing their way onward.

Thus it was that the French troops at Subijana found their position turned, and being hard pressed, both in their front and on their left, they fell back in a disordered mass and tried to gain the great line of retreat to Vittoria. Soon they dissolved into a more or less confused multitude, and but for the broken nature of the ground would have been totally disorganised and destroyed. As it was, many cannon were taken, as the English followed them in a running fight, nor was any effective stand made until they gained the last defensible height about a mile in front of Vittoria. There they turned and faced their foes, for chaos reigned behind them, between them and the city, and the plain was blocked with a confused collection of carriages and animals, non-combatants, women and children, all huddled together in panic stricken helplessness. As Napier says:—"It was the wreck of a nation."

With desperate energy the French gunners laboured to delay the ruin they could no longer avert, and 80 guns massed together again opened a terrible cannonade, while the remains of their armies formed up between the villages of Ali and Armentia and made a most determined resistance.

Now it was that another famous artillery duel took place, and that our guns, handled with an unusual boldness, and in a manner calculated to develop their effect to the fullest extent, did such excellent service. The great mass of French guns brought our advance for a time to a stand-still, and they had begun to disengage their infantry in succession from the right, when the 4th Division carried the hill on their left, and immediately all the heights were abandoned.

Seeing the great road blocked, the French endeavoured to gain

another line of retreat, and moved so as to leave Vittoria on their left. The new road, however, led through a marsh, and was soon as impassable from the press of fugitives and vehicles upon it as had been the other. Thus everywhere there was confusion, and no outlet for escape. The rout was in fact complete, guns, ammunition and stores were abandoned, and trophies innumerable fell into the victor's hands.

While Wellington was thus winning his battle, a detachment of Graham's column had gained the royal road at Durana and had denied it to the French. The part of his force, however, which endeavoured to cross the Zadora at Gamara Mayor was held in check, and at the bridge of Ariaga, which Graham himself had attacked, the French were also able to keep their foes stationary. But when Wellington's advance had reached Vittoria, Reille, who commanded the French forces on the right, saw his rear threatened by British cavalry, who penetrated Vittoria and emerged between that town and the river. The Allies were in fact soon coming down on him from Durana, Ariaga and Vittoria, and but for a reserve which he had formed at Betonio, and which covered his retreat, his situation would have been desperate. As it was, he was able to gain Metauco on the general line of retreat in some order, although he could not extricate himself without the most determined efforts on the part of those he led. Thus ended the battle, but not the efforts of the English artillery, for during the pursuit they were at hand whenever required, and in the hands of Sir Alexander (then Colonel) Dickson, gained high praise from the Duke of Wellington. In his despatches he wrote of it, "The army is particularly indebted to that corps."

The number of guns captured from the French amounted to 151, besides 415 caissons, 14,249 rounds of ammunition, 40,668 lbs. of gunpowder, and 1,973,400 musket cartridges, besides an immense quantity of treasure and other spoils. For the services of the artillery on this occasion a special boon was granted to the senior officers engaged which was to commemorate, in the words of Lord Mulgrave, the Master-General of the Ordnance, to Colonel Dickson,[1] "The very striking and unexampled circumstance of the whole of the British artillery having been brought into action, and the whole of the enemy's artillery having been captured." He goes on to say—"His Royal Highness has been graciously pleased—in consideration of the peculiar circumstances above stated—to mark his Royal Highness's approbation of the particular and successful activity of the corps of Royal Artillery under your orders, by granting severally to the officers entrusted with the command of divisions or brigades an allowance for good service in the following proportions:—To the officers commanding divisions, each 10s. per diem; to the officers commanding brigades, each 5s. per diem; and to yourself a similar allowance for good service of 20s. per diem."

These very exceptional rewards, highly complimentary as they were to the Royal Artillery, having been decided on without reference to the Duke of Wellington, proved anything but the boon intended, and to them and the circumstances under which they were granted is to be

[1] *See* Duncan's "History of the Royal Artillery."

attributed the prejudice which must have biassed the Duke's mind when he wrote in terms of most unmerited disparagement of the behaviour of the artillery at Waterloo.

Until his letter appeared to light in 1872, there appeared to be a concensus of opinion as to the gallantry displayed by our troops and batteries in the most decisive battle they had ever taken part in.

To those anxious to master all the details of the controversy set on foot by the letter referred to, the pages[1] of the "History of the Regiment" are open, and eloquent testimony is brought forward in them to vindicate its reputation. Here it can only be added that artillery cannot advance to reap the harvest of its performances as do the other arms, and can bear back no trophies to keep green the memory of their deeds. It is our proud boast that at Waterloo, as in all our glorious battles at the commencement of the century, which were mainly fought against superior odds, our guns formed the rallying points to our lines, lent the steady support to the infantry which they most needed, and rendered possible the ultimate advance, in the glory of which they could not participate, but of which they justly may demand a share. And further, it may be justly claimed that the great cavalry charges on our line at Waterloo were chiefly defeated by the fire of our guns served up to the very last moment with splendid courage by our gunners, and with most destructive result. Mercer's journal has made us all familiar with the story, and the pile of dead he tells us was so high in front of where his troop stood that it was noticeable from the French position on the opposite slope.

Major Rudyard, writing to the historian of the campaign of his experiences, says of the doings of his battery—"When advancing on our fire I have seen four or five men and horses piled upon each other like cards, the men not having even been displaced from the saddle, the effect of canister."[2]

Sir Augustus Frazer says—"The earlier hours of the battle were chiefly affairs of artillery, but, kept down by the admirable and steadily continued fire of our guns, the enemy's infantry could not come on *en masse*; and his cavalry, though bold, impetuous, and daring, was forced to try the flanks rather than the front of our position. The steadiness of our infantry, too, became confirmed by the comparative repose afforded by our fire."

The victory at Waterloo was due to the harmonious co-operation of all three arms striving loyally for the same object and controlled by a master hand in tactics in united and reciprocating efforts. It would be invidious and ungracious to endeavour nicely to guage the exact proportion of their individual shares in a result due so greatly to the courage and self-sacrifice displayed by all alike. Nevertheless, in cases where an arm, owing to the absence of any tangible trophies, has had its performances called in question by our leader, and has in consequence perhaps hitherto received less than its fair share in the credit of the day, it may justly assert the value of co-operation which, if it accomplished nothing exceptionally brilliant, was none the less real and

[1] Appendix to Duncan's "History of the Royal Artillery."

[2] Siborne's "Waterloo Letters," No. 99.

effectual. While men died, or retreated to securer positions, the guns remained in position, and, temporarily overwhelmed, were ever found as the fight rolled back uninjured where they had been left. The arm least affected by losses was always ready to do its work as soon as the retreating wave allowed it to be again manned, and the iron front of the guns ever remained, no matter how much thinner the line grew on either side, while the redoubled exertions of their diminishing detachments kept them still supplied with an unslackening fire. It is scarcely possible to exaggerate the encouragement that must thus have been afforded, but who may accurately measure it, or define its value in a narrow paragraph?

NOTE.—In a previous chapter we have recorded the opinion of Decker as to the quality of the British Artillery at the close of the Seven Years' War. That it bore an equally high reputation at the close of the Napoleonic era is evidenced by the two following extracts:—

In the "*Memoires du Maréchal Marmont, Duc de Raguse,*" Tome 7, page 116, is to be found the following passage:

"Before leaving Ghent in 1815, previous to Waterloo, I wished to see a company of English Horse Artillery which was there. The English material is so different from what we used formerly that the comparison was curious, I therefore examined it in detail, and I admired the simplicity of the construction, since adopted in France."

Mercer also says:

"Being on the subject of reviews, I may as well note here one that took place yesterday, which I have just heard of, but did not see."

"It seems that we" (*i.e.*, the Horse Artillery), "have been the *rara avis* of the day ever since our review. The rapidity of our movements, close wheeling, perfection of our equipment, etc., etc., excited universal astonishment and admiration. The consequence of this was an application to the Duke for a closer inspection, which he most magnanimously granted, and ordered Ross's Troop out for that purpose. They paraded in the fields near Clichy. The reviewers were, I understand, *Marechaux de France*; but there was also a great concourse of officers of all nations.

After the manœuvres the Troop was dismounted, and a most deliberate inspection of ammunition, and even of men's kits, appointments, shoeing, construction of carriages, etc., took place. I believe they were equally astonished and pleased with what they saw, and, as there were several among them taking notes, I have no doubt that we shall soon see improvements introduced into the 'Continental Artillery,'" *vide* Mercer's Memoir, Vol. II, pages 194, 195.

PART III.—Chapter I.

The Transition Period.

After the downfall of Napoleon the peace of Europe remained unbroken for many years, and when nations had recovered from the strain of the continual wars of his period, and became vigorous enough once more to pick up the sword, many of the lessons of the great battle-fields had been forgotten. Men disgusted with fighting had been ready enough to turn their thoughts away from the study of war, and gave their best energies to subjects which there had been no time to attend to during the late turmoils, and amongst other branches of military science the art of handling guns, and an appreciation of their value, seemed to have died with the great master who understood so well how to turn them to account.

A few examples of great artillery strokes deliberately planned do however stand out at intervals during the forty years of comparative peace which succeeded Waterloo. The Russians, during the war when they finally crushed Poland in 1831, true to their traditions, relied much on a numerous artillery, and employed their guns in masses to strike decisive blows. At Grochow, on the 20th of February, a battery of 40 guns was brought up towards the close of the engagement, and mainly decided the fate of the day. "*Et surtout une batterie de 40 bouches a feu prit en écharpe toutes les colonnes en arrière de bois; la position ne fut plus tenable.*"[1]

In the autumn of the same year, at the capture of Warsaw, the final act of the war, the part played by the Russian artillery was especially conspicuous, and has attracted the attention of all writers on the arm. Major-General Owen, in his "Modern Artillery," has brought forward this battle as furnishing an instance of the correct handling of artillery, and quotes the opinion of Jomini that it was one of the "most splendid operations of this kind."[2] Taubert also dwells on this example of the use of a mass of guns in the attack of entrenchments.

The Russian force, which on the 6th of September was in front of the Poles entrenched at Warsaw, consisted of 118 battalions, 120 squadrons, and 386 guns. On that day a great battery of 120 guns was concentrated so as to bring an overwhelming fire to bear on the Polish works, and after a two hours' cannonade the columns of assault, accompanied by Horse Artillery, advanced and captured four strong detached redoubts (Nos. 54, 56, 57, and 59). On the following day a truce was declared till 1 o'clock, but then the attack recommenced, and the Russian artillery divided into two great batteries, or, according to Brzozowski, one battery of 200 guns, advanced to within 800 paces of the entrenchments. Only a portion of the Polish artillery on the ramparts could reply, the greater number not bearing on the field of combat; but the Field Artillery, 30 guns, were deployed, and 23 pieces in the works took the Russian lines obliquely and caused great havoc amongst them. The Polish artillery was, however, completely silenced at 5 o'clock, and two Russian heavy columns of infantry advancing in the centre pierced the line of their opponents, and after-

[1] "La Guerre de Pologne en 1831." Par Lieut. Brzozowski.

[2] Summary of art of war.

wards the other points, being thus taken in flank, were captured with comparative facility.

At the battle of Sobraon, 10th February, 1846, a mass of guns was made use of with great effect at the suggestion of the Governor-General, Sir Henry Hardinge, and contributed in no small degree to our success, even if it was not entirely responsible for it. Sir Henry Hardinge's account, given in a letter to Sir Howard Douglas, published in Fullom's life of the latter, says "we should have been repulsed had we not persisted in using 36 heavy guns to bombard the enemy's camp before the infantry assault was delivered. The two field officers of Artillery and Engineers, with the Governor-General, pointed out to him that, as the enemy had only field guns in their camp, the heavy guns being in battery on the other side of the river, our heavy guns and mortars might cannonade their camp at such a range as would preclude an effective reply on their part. Sir Henry fell in with the suggestion, which he recommended to the Commander-in-Chief (Gough). The next day these officers changed their opinion, and told the Commander-in-Chief that as their men would be in open battery they would be cut to pieces. Sir Henry Hardinge, however, took a different view, and pressed his opinion, backed up by that of an Engineer officer, Major Abbott, so strongly upon them, that they again altered theirs, and agreed that they would make their 36 guns very effective, and we agreed to make the attack."

"The guns began at daylight. We could not see from the haziness of the morning what was the effect produced, but we saw they all went into the camp. Only *two* of our artillerymen were even wounded."

The subsequent assault by the infantry, after two repulses had been experienced, was eventually successful, and our left, which had expected to meet with a heavy fire from the enemy's batteries on the other side of the river, were astonished to find themselves unmolested by them. The mystery was afterwards explained. The Sikhs in the camp had been so discouraged by the bombardment which dismounted some of their guns, and killed their men from a distance beyond the powers of their guns, that they sent to the batteries on the other side of the river, and took away all their artillerymen to reinforce those in the camp, took up two of the boats of the bridge, and told their men that there was no retreat. Sir Henry Hardinge concludes with the following testimony to the effect produced by our artillery :—"By this piece of good fortune we suffered a less severe loss than we otherwise should have done; and in confidence I will say that, if the 36 heavy guns had not been brought to bear, we should have been repulsed, for they did much execution, and produced the effect of causing their heavy batteries to be of no avail. Our captains of troops and batteries are good."

This example of the employment of artillery is also alluded to in his "Modern Artillery" by Major-General Owen, who points out how much our artillery were subsequently indebted to Lord Hardinge, in as much as it was he that was mainly instrumental in raising it to a respectable strength shortly before the Crimean War.

Chillianwallah (13th January, 1849), is not a victory of which we, as a nation, can feel particularly proud, for surely never was leadership more lacking in a battle, nor can a fight at the close of which the

enemy is repulsed, not broken, and the victor's retreat from the battle-field to protect their baggage, be reckoned as a complete success. Yet much brilliant conduct on the part of isolated units shines out here and there through the sad story of muddle and impatience, and amongst instances of such the splendid behaviour of our artillery must be recorded.

When the two brigades on the British right were separated by the inroad of the Sikhs and found themselves assailed on all sides and unable to render each other mutual support, when in short the fortune of the day was distinctly in the balance, it was the behaviour of the Bengal Horse and Field Artillery which retrieved disaster. Colonel Malleson,[1] the historian of the battle, thus speaks of their services—"Splendid as is the record of that noble regiment" (he appears to think it was all Horse Artillery), "it may be confidently asserted that never did it render more valuable, more efficacious service to its country, never did it tend more to save a rash and headstrong General from the defeat he deserved than on that memorable 13th of January. The battery[2] of Dawes, attached to Gilbert's division, was, at the crisis I have described, of special service."

Durand records that "in spite of jungle and every difficulty, whenever, in a moment of peril, he was most needed, Dawes was sure to be at hand; his fire boxed the compass before evening, and Gilbert felt and handsomely acknowledged the merit and the valour of Dawes and his gunners." Colonel Malleson in a footnote also quotes the following words from the "Journal of a Subaltern" of the 2nd Europeans: "Dawes's battery was the saving of us," and Thackwell[3] draws from the same source many similar expressions of appreciation.

From Goojerat, 21st February, 1849, Lord Gough's last battle and his best, an instance of good service done by artillery may also be quoted, and it is a no less skilful and scientific a soldier than Havelock that testifies to it.[4] In the memoir of him by Marshman, a letter in which he gives an account of the battle is published. He says:—

"The Singhs, ever ready with their guns, seemed as usual anxious to have the first blow, and opened the batteries on the British at an unusually long range. The infantry was halted beyond the reach of their round shot, and the artillery, protected by skirmishers, pushed boldly to the front. A cannonade was commenced about 9 a.m., of which the oldest and most experienced soldiers in the army had never witnessed the parallel for magnificence and effect. It continued somewhat more than two hours and-a-half, the Field Artillery firing at the rate of about 40 rounds each sixty minutes, and its results exceeded the most sanguine expectations, even of those who had most boldly advocated this mode of reading warriors, who piqued themselves on their artillery powers, a great and abiding, it may be, a final lesson.

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[1] "The fifteen decisive battles of India."

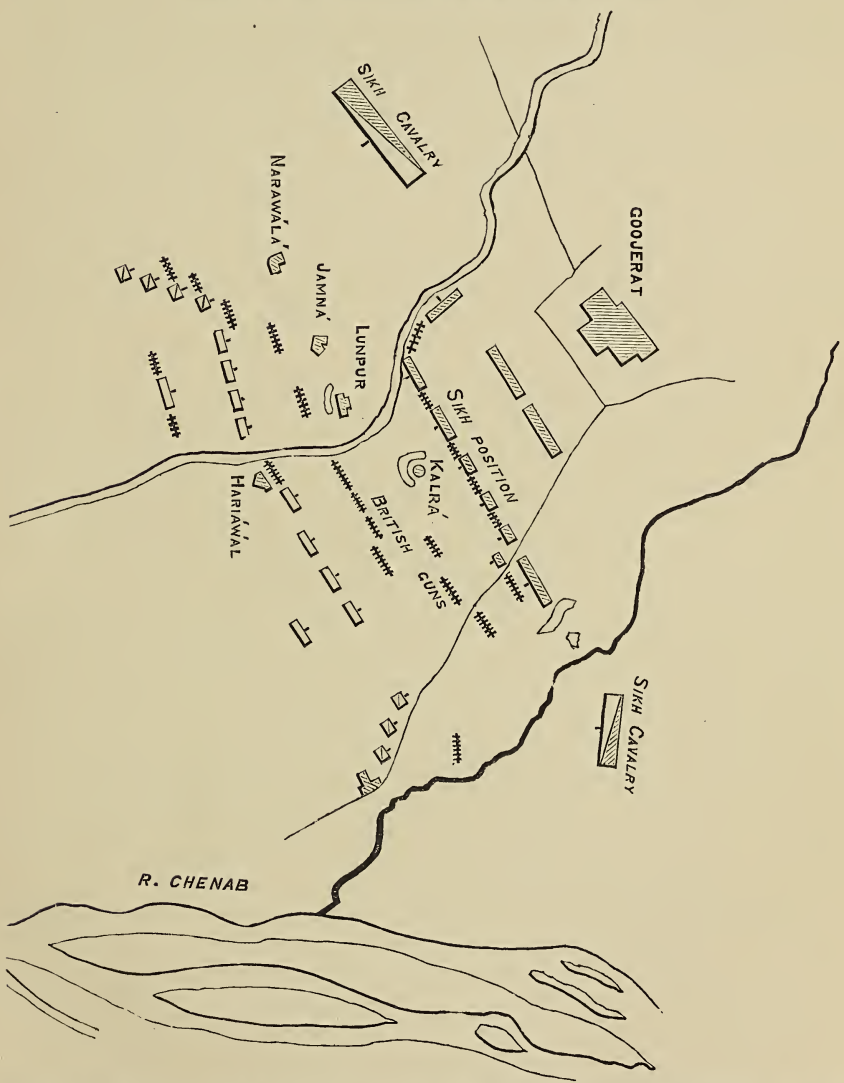
[2] This was a Field Battery, was then the 3rd Company 1st Battalion Bengal Foot Artillery, and is now the 53rd Field Battery.
Captain Michael Dawes, its commander, retired from the Army 1st January, 1858, as a brevet Lieut.-Colonel and C.S.I. Died the 30th of May, 1871.

[3] The second Sikh war.

[4] "Memoirs of Sir Henry Havelock," by John Marshman.

Notwithstanding the quickness with which the Sikh guns were served, it was soon seen that neither human fortitude nor the best material could permanently withstand the storm. Numerous guns were dismounted, and the fire of the formidable line, before a musket had been discharged, evidently slackened. Then the infantry deployed, and commenced a steady advance, the heavy guns as well as Field Batteries keeping pace with the troops, and unlimbering for effective action in successive positions. The cavalry which had been wisely restrained from taking too prominent a part in the action until the

BATTLE OF GOOJERAT.—21st February, 1849.



enemy's centre was forced, and his infantry signally defeated, was at

length called upon to exercise its most terrific function of improving victory. The Sikh line was broken and in flight, and its fragments pursued by four steady divisions of infantry. Then from either flank the horse, unbroken and in perfect order, swept forward to do the work of final retribution. The two columns speedily got into communication. Onward they moved in unison, cutting down, dispersing, riding over, and trampling the flying or scattered infantry, capturing guns and wagons, strewing the path with dead and dying, forward they moved in their irresistible course, and converted a beaten army into a shapeless, hideous mass of helpless fugitives. It was not till half-past four that they drew rein and halted, by which time the army of Shere Singh was a wreck, deprived of baggage and standards, its camp given up to the spoiler, and 53 pieces of its cannon in the hands of its pursuers. . . . . The imposing array of the British took its field in a grand and magnificent manner, and the means employed were all calculated to produce the desired effect, and did produce it. Above all, the arm in which the English host had beyond a dispute, a preponderating power, the artillery, was well posted, and allowed ample time to develop irresistible strength. In fact, *by it this battle was won.*"

According to Lord Gough's despatches[1] the enemy opposed us with 59 pieces of artillery, while the British army mustered 72 field guns, 10 18-prs. and 8 8-inch howitzers. He thus refers to the conduct of the artillery:—

"I halted the infantry just out of fire and advanced the whole of my artillery covered by skirmishers. The cannonade now opened on the enemy was the most magnificent I have ever witnessed and as terrible in its effect. The Sikh guns were served with their accustomed rapidity, and the enemy well and resolutely maintained his position; but the terrific force of our fire obliged them, after an obstinate resistance, to fall back. I then deployed the infantry, and directed a general advance, covering the movement by my artillery as before. . . . . The heavy artillery continued to advance with extraordinary celerity, taking up successive forward positions, driving the enemy from those he had retired to, whilst the rapid advance and beautiful fire of the Horse Artillery and light Field Batteries, which I strengthened by bringing to the front the two reserved troops of Horse Artillery under Lieut.-Colonel Brind,[2] Brigadier Brooke[3] having the general superintendance of the whole of the Horse Artillery, broke the ranks of the enemy at all points. The whole infantry line now rapidly advanced and drove the enemy before it; the nullah was cleared, several villages stormed, the guns that were in position carried, the camp captured, and the enemy routed in every direction."

And again when he is recognising the services of individuals, he says:—"To Brigadier-General Tennant, commanding that splendid arm, the artillery, to whose irresistible power I am mainly indebted for the glorious victory of Goojerat, I am indeed most grateful. Con-

[1] *See* the despatches given in the "Narrative of the Second Sikh War," by Edward Thackwell.

[2] This was Lieut.-Colonel Frederick Brind, C.B., who was shot by his orderly on the 9th July, 1857, when Brigadier at Sialkot.

[3] Afterwards Sir George Brooke, K.C.B., died December, 1882, aged 90.

spicuous as the artillery has ever proved itself, never was its superiority over that of the enemy, its irresistible and annihilating power, more truthfully shown than in this battle. The heavy batteries manœuvred with the celerity of light guns; and the rapid advance, the scientific and judicious selection of points of attack, the effective and well directed fire of the troops of Horse Artillery and light Field Batteries merit my warmest praise."

To have played so prominent a part in a battle in which 60,000 Sikhs, supported by 59 guns, were thus defeated, and their power finally broken, is a feat of which the artillery, as the Governor-General in his General Order[1] has recorded, "may justly be proud." And surely never were services more generously appreciated in the words of an official despatch than were theirs, nor would it be possible for the keenest partisan to add anything to praise so outspoken.

When war again broke out in Europe, most of the actors in the great struggles of the early part of the century had passed away, or were too old again to take the field. In the Austrian army, however, a really great soldier survived to show a later generation something of the grandeur of the earlier time. Radtzky's two victorious campaigns in 1848–49 were, however, fought in a level and closely-cultivated country little favourable to the employment of guns, and, in any case, his superior strategy made the task of his artillery an easy one, and demanded no great efforts from them.

The spell of the long peace was, now however, finally ruptured, and five later years the Crimean War broke out, and the opening experiences of that struggle gave unmistakeable proof how much had been forgotten since the days of the Peninsula and Waterloo, and how completely the first necessities of an army had been lost sight of. Something more, however, than what may be attributed to the neglect which it experienced in common with other departments of the army lay at the root of the feeling with which Field Artillery in the middle of this century was regarded. The balance between the arms of the gunner and the foot soldier had been disturbed by the partial manner in which as yet the favours of science had been distributed. The principle of rifling had at first only been applied to the infantry musket, and the relative advantage guns had hitherto possessed in range was greatly reduced, while they became endowed as yet with no corresponding advantages in other directions such as might compensate for the loss sustained. The infantry fire-arm of the Crimean era was as effective at 750 yards as its predecessor had been at 250. The small-arm had therefore become almost trebly as efficient as regards range as heretofore, while the guns at the Alma and Inkerman remained much the same as those which stood at Friedland and Waterloo. The new impulse given to infantry fire naturally drew attention away from guns, and their importance on the battle-field seemed likely to diminish.

Moreover, in our battles in the Crimea there appears a general tendency to allow the struggle to take care of itself on the part of the chief commanders. From one cause or another our leader appears not to have preserved a sustained control of the fight, and the records of our

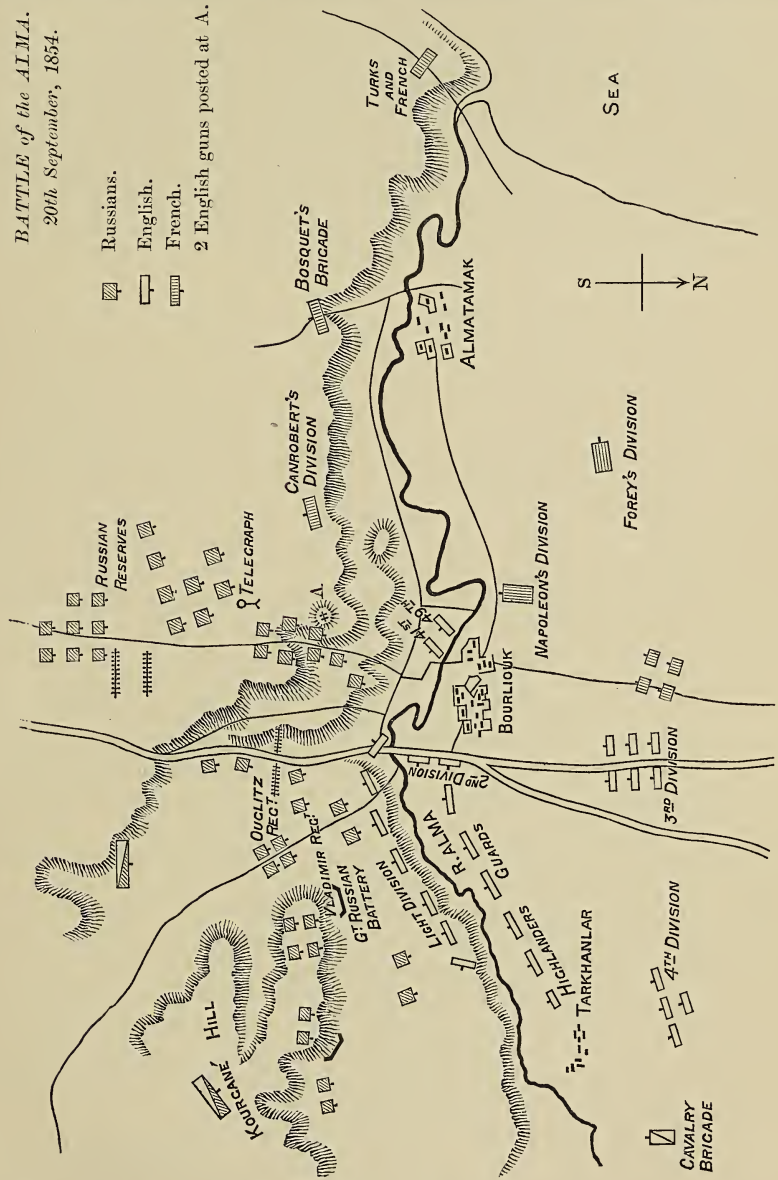
[1] General Order by the Governor-General, March 1st, 1849.

battle-fields tell us of desultory combats and a general lack of cohesion amongst the component parts of the force engaged. In such a state of things it is not surprising that, although we find several instances of artillery performing effective service on a small scale, service out of all proportion to what was to have been expected from the meagreness of the force employed, and although our batteries supported the infantry most loyally, their success was due to isolated efforts, and no concentrated blows, no masterly combinations of masses of guns, and therefore no signal triumphs for the arm, such as it could boast of at the commencement of the century, are recorded.

It is not intended here to criticise the tactics then in vogue, but rather to make note of the performances which were the outcome of such tactics, and therefore no endeavour beyond the little that has already been said will be made to explain the absence of anything like an endeavour to obtain a concentrated effect from our guns which marked the battles of the Crimea. Such success, however, as individual effort could compass was not wanting, and it must be noted that on two occasions at least small artillery detachments exerted a marked influence on the progress of the fight. In accordance with what has been said of artillery during the Peninsular War, no very detailed account will be given of the first of these two occasions, but the second, at any rate, deserves something more than a passing notice, for on it, though the guns were but two, they materially influenced the fortunes of the day.

At the Alma the Russians kept their infantry in column, and with that preference for artillery, which has ever marked their tactics, relied on the fire of powerful batteries and the weight of the heavy masses of infantry to push their assailants back. Two batteries protected by breastworks were placed so as to sweep the post road which led directly up the heights, while a battery of 12 or 14 powerful guns, known as the "great battery," protected their right front. The English, who were opposed by two-thirds of the Russian army, deployed the two leading divisions into line, when they came within about a mile of the enemy's position, and their artillery began to make itself felt. The divisions in the second line were also subsequently deployed, and the whole advanced until the fire of the Russian batteries became very destructive. They then halted and lay down to wait for the French turning movement on their right. But although their Allies gained possession of the heights above Almatamak, they had outmarched their guns, and their progress was for the time checked. The position of the French troops beyond the river being critical, Lord Raglan now ordered the British to continue their advance. The burning village of Bourliouk broke the symmetry of their advance, the second division was obliged to get into column to pass it, and in this formation suffered heavy loss, while, even when it succeeded in pushing across the river which flowed at the foot of the Russian position, and deployed once more, the line it formed was but a broken and ragged one. Meanwhile the battalion of Rifles, who as skirmishers had covered the deployment, cleared away to the left, the light division advanced with great difficulty, the left brigade got over the river, but Codrington's brigade was checked under its high

bank. At length, being reinforced, it struggled forward in an irregular line. As it neared the great battery in front of it two heavy columns emerged against it on either flank. The eastern column was put to flight by the steady fire of the men on that flank, while the 7th Fusiliers



entered on a sanguinary fire action with the other. The central battalions meanwhile pushed forward, stormed the breastwork, captured two guns, and drove away the remainder.

The first division, which was to have supported the light division,

by some misunderstanding delayed on the river's bank, and Codrington's brigade, unsupported as it was, being assailed by the Vladimir column, was driven down the hill again. On the right meanwhile Pennefather's brigade of the second division had pushed forward and was actively engaged with the two "causeway batteries" commanding the main road. The Russian artillery fire was sweeping the front with terrible effect, and hitherto, owing to the nature of the ground, the English batteries had done but little to support the advance of the infantry. At this juncture Lord Raglan, who with his staff had advanced to a knoll actually inside the Russian position, perceived that a few guns placed where he was would take the "causeway batteries" in flank, and would also similarly assail the formidable Vladimir column which had defeated Codrington. Orders were hastily given to bring up two 9-prs. of Turner's Field Battery, and soon they were hurrying forward at the trot.

In those days, however, field guns had no means of carrying their gunners with them, and so when their guns arrived on the scene only a single non-commissioned officer was available for their service. The officers with them,[1] and those on the staff of General Strangways, who commanded the artillery, dismounted,[2] and served the gun to such purpose that they forced the two powerful "causeway batteries" to retire, shook the great Vladimir column likewise and stayed its advance, as also that of the Ouglitz battalions which were moving to its support. Finally they turned their attention on the Russian reserves, and soon they too fell back. Moreover, the unexpected fire coming apparently from the heart of their own position demoralised the column which was disputing the ground on the flank of the great redoubt with the 7th Fusiliers, and it too began to yield its ground before them. In short, the marvellous effect produced by two 9-prs. advantageously placed was such that the whole complexion of the day was altered. The Guards advanced on the earthwork where the great battery had stood, stalled off the effort of resistance made by the Vladimir column, and captured and finally held the work. The way had been smoothed to victory, and the success of the English was now assured. The Highlanders turned the enemy's right, and Pennefather pressed them back on the west of the redoubt. The battle was in fact won.

While criticism cannot fail to note the small use to which the Allied artillery, which numbered 128 guns, was turned, and how small was the assistance they rendered to the infantry, credit can never be refused to the performances of the two guns we have alluded to. Their action at a moment when the balance swayed between success and failure was decisive, and if two guns could exercise so extraordinary an influence on a fight, we may well draw inferences to what more skilful handling might have effected with the remainder.

It is thus that the historian of the war has spoken of what these guns accomplished for their side:—"The fire of Lord Raglan's two guns had enforced the withdrawal of the causeway batteries; had laid open the entrance to the Pass; had shattered the enemy's reserves; had

[1] One of whom was the present Sir Collingwood Dickson.

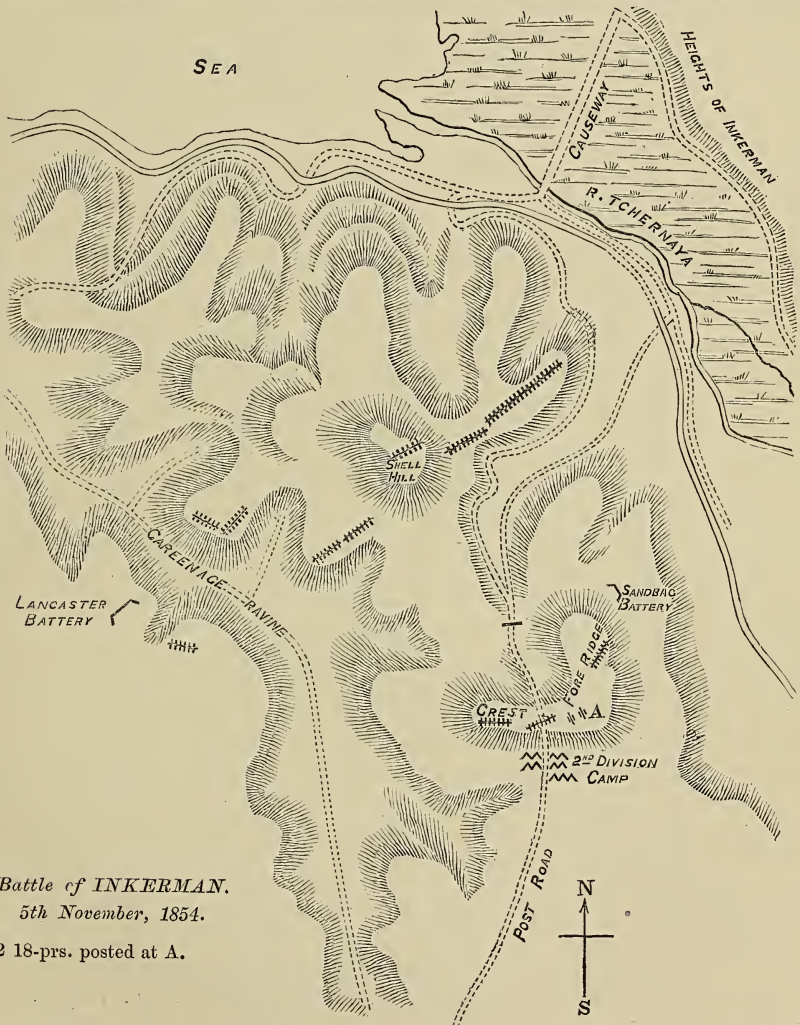
[2] Lieutenant Walsham, R.A., was killed while in the act of sponging one of these guns.

stopped the onward march of the Ouglitz battalions, and had chained up the high-metalled Vladimir in the midst of its triumphant advance."

No recognition of their services could be more complete than this.

Yet such a performance as we have thus briefly described bears on it rather the impress of individual prowess owing something to chance than of a deliberately planned and scientific application of means to an end, which from the first utilises to the full all the resources at command and blends them together to reap a great result. So, likewise, in the subsequent battle of Inkerman, two guns again emerged from the ruck to gain particular glory, and artillery put out a small fraction of its strength as if as a sample of what, had the odds been but a little less one-sided, its efforts might have accomplished.

On the 5th November, 1854, the British infantry, struggling blindly



in the mist with a huge foe whose strength they were but dimly con-

scious of, were rent and torn by the powerful artillery with which the Russians heralded the advance of their columns. At 9.30 a.m. two 18-prs. thrown into the doubtful battle at an opportune moment crushed with their weighty shells the enemy's far more numerous artillery, and without belittling the heroic efforts of the British foot soldier with whom the credit for the outcome of the "soldier's battle" must ever rest, it cannot be denied that the fire of these two guns contributed in a special degree to the success of the day. But for the destruction which their well directed fire spread amongst the 100 guns (and some of them were guns of position) which the Russians had placed in position on Shell Hill, our losses, even had we escaped defeat, must have been immensely greater than they were. But although much stress is laid on the action of these two guns, it is not intended to pass by in any spirit of disparagement the support which the remainder of the Allied artillery gave to their infantry. On the contrary, it may be stated at once that they effected all that was possible under the circumstances. It is not easy, however, to give an account of what all the guns did without unduly extending the story of a battle which it is particularly difficult shortly to describe, and, moreover, both in numbers and weight of metal our artillery were at an immense disadvantage, and, until the two siege guns arrived, were more or less dominated by the fire of their opponents. Many of the Russian guns on Shell Hill were guns of position, and even at the close of the day there were only 38 English and 24 French pieces on the ground, all of which, with the exception of two, were of field dimensions. The performance of the two 18-prs. stands out, therefore, as a distinct feature in the fighting, and in a narrative such as this must absorb all our attention.

Without entering into any further account of the battle, it may be stated, therefore, that in the early dawn the British army had been surprised by two hostile forces converging upon them, one from Sebastopol up the Careenage Ravine, and the other from the causeway across the Tchernaya. The force[1] on the west under Soimonoff numbered 19,000 men and 38 guns, while the other under Pauloff was 16,000 strong and was accompanied by 96 field pieces. At 7.30 o'clock the stubborn courage of 3600 of our soldiers, supported by 18 guns, fighting in line had repulsed the first attack which was made on our left centre. Then, however, the whole of Pauloff's force had appeared on the scene, and the Russian Commander-in-Chief, General Dannenberg, recommenced the battle with fresh troops amounting to 19,000 men and 90 guns. On our side the Guards had come up, also the batteries of the 1st Division, while Cathcart was hurrying on with 2100 men. A series of more or less isolated and desultory combats ensued, in which, if our men held their own, and even ventured in places to assume the offensive, the overwhelming odds well nigh bore them down, and they clung to their position rather as men desperately striving to preserve a precarious foothold, than as victors standing firm in pride of strength.

At 9.30 o'clock the Russians had 100 guns in action on Shell Hill, and the power of this great force of artillery enabled them to preserve

[1] According to "The War in the Crimea," by Sir E. B. Hamley.

their ascendancy over the comparatively weak force straggling along to the opposite heights. It was at this moment that the two 18-pr. siege guns appeared on the scene. They had been drawn the greatest part of the way from the siege park by manual labour, and the difficulties to be surmounted had been extreme. In fact, their 150 gunners had dragged them there themselves, and with them were Colonels Gambier, Collingwood Dickson, Captain D'Aguilar, and several other officers.

Colonel Dickson placed them in position, and almost the second round produced destructive effect. A perfect storm of shot and shell at once burst on them from the mass of guns opposite. In a quarter-of-an-hour 17 gunners fell round them, but as one man dropped another eagerly stepped forward to replace him. Meanwhile each gun was laid by an officer, the one by Lieutenant Sinclair, the other by Lieutenant Harward, and every round visibly carried havoc into the enemy's batteries. The value of the concentrated force which lies in a large gun was now well exemplified, for the weight of metal had alone to atone for disparity in numbers. Thus, what has been described as an unexampled contest between two powerful siege pieces and 100 field guns, a large proportion of them 12-prs. and also some 32-pr. howitzers, raged unremittantly, and the interest of the day became centred in that apparently unequal duel. A slight breastwork 2 feet high protected the siege guns, and accounted to some extent for their being able to maintain themselves as they did. After a quarter-of-an-hour, however, the wreck which the heavy, well directed shells spread in the enemy's batteries began to tell. While our men experienced "severe loss, the havoc they inflicted might rather be termed devastation." The enemy's fire gradually slackened, and as it did so, ours exultingly became more masterful, and our gunners suffered less. Meanwhile two French Horse Artllery batteries, taking advantage of this new succour, moved over the crest on their right, established themselves on the bare slope facing the enemy, there gallantly held their ground in spite of the shattering fire they had to meet, and joined this combat of artillery. During the second quarter-of-an-hour but two or three men fell, and the heavy shells flew ever thicker. Then the enemy's gunners grew weary of the struggle, and endeavoured by shifting the positions of their batteries to escape the pitiless tempest. Such tactics could not but hasten the end, and "within half-an-hour from the time when he brought into action the two 18-prs. Colonel Collingwood Dickson had made his ascendancy complete, and it was with almost perfect impunity that his gunners thenceforward continued to ravage the enemy's batteries."[1]

The historian we have just quoted goes on to say, "From this ruin of the enemy's artillery power on Shell Hill many hastened to infer his approaching defeat; and, in truth, the change wrought was one of great moment." He had before suffered repulses, "but the force now exerted against him was tearing at the very foundations of the power he had seized on Mount Inkerman." The two 18-prs. continued to

[1] Kinglake.

exercise so potent an influence over the enemy that it was only where he could find shelter from their shells that he could with any advantage use his guns; on our side men began to breathe more freely. The crisis of the day had passed, and, even though our reserves were all but exhausted, we had held the enemy at bay in numerous small combats for many hours, and did not, therefore, regard with apprehension the prospect of opposing him a little longer with attenuated forces. For his aggressive force was clearly sinking, and his columns were no longer supported by the heavy artillery fire which had hitherto lent them courage.

Gradually gathering confidence our infantry were even drawn on to assume an offensive *rôle*, and under cover of the two 18-prs. a battery on Shell Hill was attacked and driven off the ground. This last blow determined the fate of the day. General Dannenberg, despairing now of being able to reassert his power, suddenly gave the order to retreat. He was driven to this resolve, he afterwards stated, by "the murderous fire of artillery." That is to say that two siege guns, manned by determined men, and placed skilfully in position, had had so great an influence on the fortunes of the day as not only to subdue the fire of 100 pieces, but to impress the hostile commander to such an extent with their power that he withdrew the whole of an enormously superior force from the contest. [1] "The Siege Artillery of the English was placed in position on the field of battle and it was not possible for our Field Artillery to contend against them with advantage."

But the two gallant 18-prs. were yet to show that they could hit infantry even harder than artillery.

When the Russians determined to quit the field and began to draw off their guns, a heavy column, formed of the Vladimir Regiment 2000 strong, was sent to cover the retreat, and with a larger daring than had been thought of by the General who entrusted that task to them, moved down the slope towards the very part of our position where Collingwood Dickson's guns were placed. As the smoke lifted they were perceived, and soon the great shot were tearing through their ranks, scattering destruction amongst them just as they had spread havoc through the batteries.

The heavy column hesitated, halted, turned, and sullenly fell back. It acknowledged the superior power of artillery, and abandoned the struggle.

The last effort of the day was thus stalled off by the same guns who had brought the crisis about, and now the Russian army was at our mercy had we had but a reserve of fresh troops at hand to drive the victory home. The whole strength of our men had, however, been put forth since dawn to avert disaster, and when the triumph came they accepted it with a sense rather of relief than exultation. The enemy were beaten, but the victors were, perhaps, more exhausted than were they. As Lord Raglan at the close of the day saw the great Russian columns dragging their slow length in full retreat beneath him, he realised what he and his army had accomplished. "I have been attacked," he said, "by 40,000 men."

[1] Prince Mentschikoff's despatch.

And the performances of the artillery were acknowledged in the unwonted warmth with which he thanked Collingwood Dickson, "You have covered yourself with glory."

It was thus that the English leader expressed his sense of what his artillery had done for him on that memorable day, and in the person of their commanding officer complimented the officers and men engaged. To his praise we may, in leaving this portion of our subject, fitly add the testimony of the great military genius who sustained the war on the side of our opponents.

In his history of the Crimean War, General Todleben pays a high compliment to our batteries, and has written that throughout the battle "the English artillery sustained its infantry perfectly. It followed it everywhere and opened a close fire upon the Russian columns. On the one hand the artillery of Codrington's Brigade, established on the left side of the Careenage Ravine, swept our reserves, and took in flank the troops who advanced to attack the left wing of the English army."

(To be Continued).

THE UNITED STATES MILITARY ACADEMY AT WEST POINT.

BY

CAPTAIN A. C. T. BOILEAU, R.A.

INTRODUCTORY.

It is believed that no detailed description of the United States Military Academy has ever appeared in the R.A. Institution "Proceedings," and this being the case, it is hoped that the following account may be of interest, especially to officers educated at the Royal Military Academy at Woolwich and those otherwise connected with it; and such information will be given in this article as to enable a comparison to be made between the two Academies which it is thought may be entertaining and perhaps profitable.

For what follows the writer depends on observations made by himself on a visit paid to West Point last year, and on extracts taken from the anuual "Report of the Board of Visitors" and the "Official Register," which were kindly presented to him by the Superintendent of the Academy, Colonel John M. Wilson, of the Engineers. The Superintendent remarked that it was always a pleasure to him to welcome officers of Her Majesty's service, and in order to facilitate inspection and enquiry told off a Cadet officer (Lieutenant Mott of the Artillery) as guide and escort. The writer is also much indebted to the verbal explanations afforded by Colonel Peter S. Michie, the Professor of Philosophy (to whom he bore a letter of introduction), who courteously conducted him through every part of the Academy, showed him all that was to be seen, and hospitably entertained him at lunch in his own quarters.

The Academy, its Foundation, Object, and Cost.

The Academy was founded in 1808 for the purpose of supplying highly trained officers for all branches of the United States Army, viz., Engineers, Ordnance, Artillery, Cavalry and Infantry. With the

Americans the Ordnance is a branch of the Artillery, instead of a separate department as with us. The cadets who pass out of the Academy highest are recommended for appointment to any arm of the service, the next seniors to any arm except the Engineers, the next to any arm except Engineers or Ordnance, and the remainder to Cavalry or Infantry. The number of cadets who graduate every year is not sufficient to fill up the vacancies in the army, although the United States standing army is a comparatively small one, being 25,000 to a population of 60 millions. The establishment of cadets at West Point is 345, but they are seldom up to strength, the average number at the Academy at one time being only 265. The Academy is wholly supported by the Government, and the cadet receives his education as a free gift. The funds for the maintenance of the Academy are supplied through the Secretary of War upon the requisitions of the Superintendent. The average incidental expenses amount to £20,000 a-year, and the average annual pay of the cadets is £30,000. Of the pay of the staff there are no particulars, but it might be put at another £30,000, which would make the total cost of the whole establishment somewhere in the neighbourhood of £80,000 per annum.

West Point.

West Point is a promontory on the right bank of the Hudson River, about 50 miles above New York; it is a very pretty but somewhat desolate spot, and the neighbouring country being barren is thinly inhabited. The Government property covers 2200 acres, stretching along the shore for two miles; it consists of level plain and rugged hills. The bank of the river is, as a rule, high and steep—along the top of it runs a strip of level plain which is backed by mountains, the whole country for the most part being thickly wooded. On a portion of this level plain, which presents the form of an equilateral triangle with a side of about half a mile, are situated the Academy Buildings 150 feet above the river, and close to it; this particular portion is known as "*the* plain," and makes a capital drill ground. There is no town at West Point, and no society other than the families of the Academy Staff. There is no garrison, no arsenal, and no dockyard. There is a small hotel and a post office. There are two lines of railway, the "West Shore" and the "New York Central," the station of the former is ten minutes' walk from the Academy, that of the latter on the opposite side of the river, at a small place called Garrisons, to which a steam ferry runs from West Point. The railway journey to New York takes two hours. In summer passenger steamers ply up and down the Hudson.

The Academy Buildings.

The Academy buildings are of grey stone and present a substantial and ornamental appearance. Forming one central group are the Academy itself, the cadet barracks, the Grant hall, the headquarter office, the chapel, the library, the hospital, and the riding "hall." The officers' quarters form a line of prettily situated detached villas, extending over a mile, some looking across "the plain," and all

facing the river. At the head-quarter office are located the offices of the Superintendent and Military Staff. The remainder of the Academy buildings are scattered about all over the Government property. They consist chiefly of barracks, hospital, and married quarters for the enlisted men, and a school for their children; magazine, laboratory, guard houses, storehouses, stables, workshops, laundry, &c. The most inaccessible building is the Observatory, which is on a hill 1000 feet above "the plain" and one mile from the Academy.

The Staff.

The staff is a large one, numbering 66 all told for 265 cadets. [The Royal Military Academy Staff at Woolwich numbers 31 for say 240 cadets]. The head of the United States Military Academy is the Superintendent, who is Governor of the Academy and Commandant of the "Post" (as it is called) of West Point; his staff is composed as follows :—

Military Staff—

1 Lieut.-Colonel Commandant of Cadets.
4 Lieutenants Commanding Companies of Cadets.
1 Lieutenant and Adjutant.
1 Captain and Quarter-Master.
1 Captain and Assistant Quarter-Master.
1 Lieutenant, Officer of Police.
1 Post Surgeon.
1 Assistant Surgeon.

The senior Quarter-Master appears to combine several duties, as his full designation is "Treasurer, Quarter-Master and Commissary of Cadets, Post Commissary of Subsistence, and Post Treasurer!" The Lieut.-Colonel Commandant is also the Instructor in Tactics, and the four Lieutenants Commanding Companies are assistant instructors in the same subject. These five officers are not counted below.

Academic Staff—

8 Professors.
8 Assistant Professors.
27 Instructors.
8 Assistant Instructors.
1 Officer in charge of Observatory.
1 "Master of the Sword."
1 Teacher of Music.

Professors have the "assimilated" rank of Lieut.-Colonel, and those whose service at the Academy exceed ten years, that of Colonel. The Assistant Professors, Instructors, Assistant Instructors, and officer in charge of Observatory are all commissioned officers and, at the present time, are drawn from the different arms of the service in these proportions :—Engineers, 5; Ordnance, 2; Artillery, 15; Cavalry, 11; and Infantry, 11. The Lieut.-Colonel Commandant is an Infantry officer. Of the Lieutenants Commanding Companies, one belongs to the Artil-

lery, one to the Cavalry, and two to the Infantry. The Adjutant is a Cavalry officer, and so is the Officer of Police. No particular arm can well be said to have a manopoly. The Professor of Law is a Deputy-Judge-Advocate-General, and the Professor of History, Geography, and Ethics is the Chaplain.

There is no mention of any non-commissioned staff, and probably none exists, as the officers appear to instruct in all details themselves, while the cadets perform the duties, and hold the ranks of Staff-Sergeants, Sergeants, and Corporals of the Cadet Battalion.

Admission, How Obtained.

Admission to the Academy is not by open competition, but by nomination, subject to a qualifying entrance examination. Each Congressional District or Territory in the United States is entitled to have one cadet at the Academy, who is appointed by the Secretary of War at the request of the Representative or Delegate in Congress of the said District or Territory. The appointments are made one year in advance. In many districts a local competitive examination is held in order to decide to whom the nomination shall be given. In addition to the above, the President of the United States has the privilege of appointing ten cadets "at large," not ten annually, but ten altogether, appointed from time to time, so that there are always ten cadets from "at large" at the Academy. These are generally the sons or nephews of army officers, but those cadets appointed in the ordinary way may be of any social standing, and whether they be the sons of capitalists or the sons of wage-earners, they are all held to be equal, as the principles on which the Academy is governed are strictly Republican.

The Entrance Examination.

The nominee must report himself at West Point early in June. Soon after his arrival he is subjected to a rigid physical examination by a Board of Army Surgeons, by whom an average of 13 per cent. are rejected, and it is interesting to find that nominees for the United States Academy are recommended to get themselves examined, as a preliminary trial before leaving their homes, by a "skilled army surgeon" in preference to the "family physician."

When the nominee has passed the physical examination he has to undergo a literary examination in elementary subjects. This examination is qualifying, not competitive. To pass he must be well versed in reading, writing and arithmetic, and have a knowledge of grammar, geography, and the history of the United States. In spite of the low standard of this test, an average of 32 per cent. of the nominees fail. The examiners are officers of the Academy Staff.

Joining the Academy.

The nominees who fail in either of the entrance examinations return whence they came, while those who pass proceed to join the Academy at once without going back to their homes. They must now hand over to the Treasurer a sum of £20 to cover the expense of their first outfit, which costs about £18. Cadets on joining receive a "Warrant of

Appointment," but before getting it they must sign an "engagement paper," and swear and subscribe to an "oath of allegiance." The former is to serve eight years in the United States Army, including time spent at the Academy; the latter is to support the Constitution of the United States, bear true allegiance to the National Government, and obey the legal orders of superior officers and the articles governing the armies of the United States.

The Cadets.

The cadets are smart, well set up, and well turned out; their age on joining is 17 to 22, and their minimum height 5 feet. Their uniform is very neat, the undress consists of dark blue kepi and shell jacket, and French grey trousers with broad stripe (Fig. 1.); it is understood that the

Fig. 1.

full dress is the same, except that the shako takes the place of the kepi. The rank and file cadets are armed with Springfield rifles (cadet pattern), ·450 bore, with bayonets, and accoutred with white shoulder-belts, white waist-belts, and McKeevor cartridge boxes. Sergeant-cadets carry a second shoulder-belt and a straight sword; 1st Sergeant-cadets, besides all these things, have a sash. Officer-cadets wear swords, shoulder-belts and sashes. New cadets are called "plebes"—a more classical nickname than "snooker!" The cadets have very little time for amusement, and it is not an exaggeration to say that they do not get more than half-an-hour to themselves the whole day. They are marched straight from study to drill, and from drill to study. At West Point the official term for drill is "enforced recreation!" The result of this is that the cadets are unable to indulge in much "volun-

tary" recreation, and play no games except an occasional game of bowls in the bowling alley, and a baseball match on Saturday afternoon, when they get a half holiday. There is no cricket, football, or rackets. They give occasional dances, notably the "Graduation Hop," in June, to which people come from New York in large numbers. Ladies at West Point are at a premium, and one young lady who resides there mentioned to the writer that one Sunday she had recently walked with five cadets—not all at once, but separately—and that, by a well understood custom, Sunday is divided up into five regular "walking-out" periods, each known by some distinguishing name, such as the "church parade walk," the "guard mounting walk," &c.

The Cadet Battalion.

For instruction in infantry drill, military police, and discipline the cadets are organised into a battalion of four companies, "A," "B," "C" and "D," under the Lieut.-Colonel Commandant, each company being commanded by a Lieutenant in the Army, there is also a Captain-cadet to each company, but he, of course, takes his orders from the Army Lieutenant. There is an Adjutant, Quarter-Master, Sergeant-Major, and Quarter-Master-Sergeant to the battalion, all of whom are cadets. There are three Lieutenants, one 1st Sergeant, four Sergeants, and five Corporals to each company, who are also cadets. All are selected for their efficiency and, as a general rule, the Officers are taken from the 1st Class, the Staff-Sergeants and Sergeants from the 2nd Class, and the Corporals from the 3rd Class.

Interior Economy.

There is a very nice little Officers' Mess for the Staff, who sit down to dinner about 12; most of the Staff being married, live in their quarters. The cadets have all their meals in the Grant Hall, where they are divided into a number of messes. Their food is of good quality, well cooked, wholesome, and varies according to the season. The cadets have to pay for their messing, which costs, on an average, £3 5s. 9d. a month. They get medical attendance, medicines, quarters, fuel, and lights free, with the exception of a small share of gas burnt, which comes to about 1s. 3d. a month for each cadet. There is an Academy band of 24 performers. A drum and a fife seem to take the place of our trumpet and bugle, as the cadets turn out and fall in to the sound of them. A cadet must keep up his uniform and clothing at his own expense, he has also to pay for his belt and sash—the latter, as worn by the Officer-cadets, costs as much as £5, but serves them for use after obtaining their commissions. All articles of clothing are of uniform pattern, and are sold at the Academy at regulated prices. The pay of a cadet is £111 a year, or £9 5s. a month. No cadet is permitted to receive money from any other source without the sanction of the Superintendent. With proper economy a cadet's pay is said to be sufficient for his support while at the Academy, but it must be a pinch to make both ends meet, judging from the number of things he has to pay for. To begin with, 16s. 8d. a month is set aside to pay for his outfit as an officer on graduation, by which time this stoppage has

amounted to nearly £40; then he has to pay for his messing, clothing, and books, besides a host of minor charges, such as washing, barber, "policing barracks," shoe-blacks, baths, share of gas, &c. If, in spite of all these expenses, his pay should run to the good, he is not allowed to handle any of it except when he goes on furlough. The cadets live in barrack-rooms, two in each; they are only furnished with what is absolutely necessary, and the walls and floor are bare, their beds are made up like soldiers', and their kits have to be kept very neatly stowed at all times. The officers visit the rooms frequently and at all hours, which accounts for the upstairs ones being the most popular! As regards religion and morality, the morals of the cadets are said to be good. The Academy is unsectarian, and no particular church is pressed upon unwilling cadets. It is considered sufficient to conserve as much conscience and religious conviction as a cadet brings with him on joining, and to show a proper tolerance for those who "profess and call themselves Christians." There are Chapel services and a Sunday-school on Sundays, and two prayer meetings a week on other days. The voluntary services are well attended. There is a Chaplain to the Academy, but to what Church or Denomination he belongs the writer cannot say. One of the officers spoken with was a Swedenborgian.

Discipline.

The discipline is very strict but impartial, and is uniformly sustained. Cadets are tried by court-martial. Minor offences charged against cadets are read out on parade, and they have to send in a written reply by next morning. Saturday, in the afternoon, is the great day for punishment drill, it is the only week day upon which the cadets have any time for this form of "enforced recreation." What would a Woolwich cadet think of a syllabus of instruction which does not admit of time for "hoxters?" Except in extreme cases, cadets are allowed but one leave of absence during the four years' course, and that, as a rule, at the end of the first two years.

Drills and Exercises.

During their four years at the Academy the cadets are instructed in the drill of all arms, and in field and siege works, and pontoon and spar bridges. They are also taught riding, gymnastics, fencing, bayonet exercise, signalling and swimming. As regards infantry work, they learn company and battalion drill, and to mount guard. They have a rifle range for target practice. For cavalry work 80 horses are kept at West Point and are looked after by a detachment of enlisted men from the regular army. According to the Captain-Instructor of Cavalry they are nothing to be proud of, being "rough looking and half groomed, with rusty bits and shabby untidy trappings," and their appearance is "disgraceful, compared with the worst cavalry troop in the army." This undesirable state of affairs he attributes to a variety of causes, chiefly his men being taken away for other duty, and the horses being used for the Field Battery. On these 80 horses the cadets learn riding and cavalry drill, and on parade are formed into a

"battalion" of four troops. There is no Riding-Master at the Academy, equitation being taught by the Captain-Instructor above referred to, who is, of course, a cavalry officer.

In artillery matters they are behind at West Point, and their armament is inferior, but there is a splendid artillery range at the barrack gates, so to speak, extending for miles up the Hudson, which at this part is very wide. There are three batteries for the use of the cadets—the Coast Battery, the Siege Battery, and the Field Battery. The Coast Battery is situated on the river side, and is armed with two 15-inch S.B. guns, three 8-inch R.M.L. guns, and one 13-inch mortar; no two guns are mounted on the same kind of carriage, and all the carriages are experimental. The Siege Battery is placed on the edge of "the plain," also bearing up the river, and is armed with six 30-pr. R.M.L. guns (Parrot's), three 8-inch mortars, and three 10-inch mortars. The guns in both these batteries are said to be old and dangerous, and one of them recently exploded. The Board of Visitors says "they are a peril and, but for that, would be a joke." The Captain-Instructor of Ordnance and Gunnery explains that "although obsolete they are the best the conntry can now supply," and adds that a new R.B.L. steel armament has been promised (including a 12-inch R.B.L. 'mortar,' whatever that may be). A Maxim machine gun and Hotchkiss Q.F. gun have been applied for. The Field Battery consists of six 3-inch R.M.L. guns, teamed by 48 horses supplied from the cavalry detachment, and driven by the enlisted men of the same. This arrangement, as has already been stated, is not considered satisfactory from either an artillery or cavalry point of view. The horses having been bought for the cavalry are unsuited for artillery work, and using them for the one arm (it is said) spoils them for the other; the harness does not fit, and the cavalry troopers are uninstructed in driving. The guns are obsolete, and the whole battery is described as a "make-shift," which can never be an efficient means of instruction for the cadets. A new battery of six 3·2-inch R.B.L. steel guns has been promised. It is proposed to have a Field Battery of the regular army quartered at West Point. No artillery drill is carried out in the winter. Speaking of artillery generally, the Lieutenant-Instructor of Artillery says "that cadets leave the Academy conspicuously deficient in this branch is inevitable under the prevailing system." From the termination of the examinations, about the middle of June, until the end of August, every year, the cadets live in camp on "the plain," and are engaged in outdoor military duties and practical instruction.

System of Instruction.

We now turn to the theoretical instruction of the cadets and their studies indoors. The academic year begins after the camp is broken up on 1st September, and continues until the 1st June following. The cadets are arranged in four classes, corresponding with the four years of study, the first year cadets constituting the 4th Class, and the fourth year cadets the 1st, or Graduating Class. The average number in each class is 66. The classes are divided into small sections, having an average of a dozen cadets in each. There is an Instructor to each section,

the Professor taking the 1st section. The cadets are marked daily for their work, and by these marks they are frequently moved up to a higher, or down to a lower section, so that the cleverest and most industrious are always rising to the top, while those who are the reverse gravitate towards the bottom. Thus they cease to get in one another's way, and eventually cadets of similar capacity are in the same section. All cadets joining the Academy have to go through the same *curriculum* irrespective of what branch of the Army they are intended for, and all cadets in the same class must study the same subjects, keeping step or marking time together, advancing simultaneously, and going through a book in line abreast, as it were. There is no dashing ahead, nor falling out to linger over interesting problems. The cadets are kept up to the mark by a process of weeding out at the bottom of the class, which prevents the pace being set "to suit the slowest horse." This is demonstrated by the number of cadets who have to leave the Academy. In 1890, 22 cadets were discharged and 10 resigned, all of whom were in the 4th Class save three. On an average 50 per cent. of the cadets joining fail, and nearly all in their first year! A notable characteristic of the teaching at West Point is that it is chiefly done by what is called "Recitation"—a system of verbal instruction in which the cadets figure as instructors of themselves. Imagine a section of cadets assembled in their class-room for two hours' study—the Instructor divides the task for that study into a certain number of parts, allots them at once to certain cadets, and, after they have had an hour or so to get them up, he calls upon these cadets, one by one, to stand out by the blackboard and, without the book, to explain what they have just learnt in an audible voice to the other cadets, the Instructor following attentively, and correcting mistakes as they occur. This is called "Recitation," and is the system employed all through the Academy; it gives the cadets confidence and self-reliance, and prevents them idling in study, nevertheless it is not intended to enable the cadet to learn his lesson therein, but rather to clear up possible misconceptions respecting the lesson itself.

Course of Studies.

The West Point course is severe and of a high standard. There are no voluntary subjects, and the obligatory ones must be mastered by every cadet. The following syllabus will speak for itself:—

4th Class, 1st Year.

Mathematics—Elementary Algebra and Trigonometry, Geometry, Analytical Geometry, and Surveying.
English Grammar, Rhetoric, and Composition.
Ethics and Universal History.
French.

3rd Class, 2nd Year.

Mathematics—Analytical Geometry, Descriptive Geometry, Differential and Integral Calculus, and Method of Least Squares.
Drawing—Topography, Practical Surveying, Geometry, Shades, Shadows and Perspective, and Isometric Projections.
French.

2ND CLASS, 3RD YEAR.

Mathematics—Elements of Analytical Mechanics.
Physics—Sound and Light, Heat, Electricity, and Magnetism.
Other Sciences—Astronomy, Chemistry, Eclectic Physiology, Mineralogy, Petrography, and Elements of Geology.
Drawing—Freehand, Landscape in black and white, Constructive and Architectural.
Tactics—All arms. The service of Heavy Artillery.

1ST CLASS, 4TH YEAR.

Engineering—Civil and Military, Field and Permanent Fortification, Siege Operations, and Stereotomy.
The Elements of the Art of War.
Ordnance and Gunnery.
Spanish.
International, Constitutional, and Military Law.
Outlines of the World's History.
Historical Geography.
Practical—Astronomy, Surveying, Reconnaissance, Field Telegraphy, Ballistics, and Pyrotechnics.

PERIODICAL EXAMINATIONS.

The examinations of the several classes are held half-yearly in January and June. At the former new cadets are given standing in the 4th Class according to merit. The June examinations are the most important, as the removes take place after them, and the Graduating Class get their commissions. After both examinations cadets found deficient in conduct or studies are discharged from the Academy. The examiners are taken entirely from the Academy staff. They consist of the Professors, the Commandant, and one or two Instructors. They are formed into two Committees and divide the work of examination between them. The examinations are partly written and partly oral, but chiefly the latter—even in such subjects as mathematics! Here the practice the cadets acquire at "Recitation" stands them in good stead. The examinations are very thorough.

THE BOARD OF VISITORS.

The Academy is inspected every year at the time of the June examinations by a Board of Visitors. This body consists of 12 members, seven of whom are appointed by the President of the United States, two by the President of the Senate, and three by the Speaker of the House of Representatives. The Board is largely composed of distinguished persons of nearly all professions, including men of high position in the Government, Presidents and Professors in the most prominent educational institutions, military officers, Doctors of Divinity, Doctors of Medicine, and others. They appear to make an exhaustive examination of the Academy and everything connected with it, and, with this object in view, the Board spends the best part of a fortnight at West Point, the members putting up in the hotel there. They are present on "Graduating Day" (our "Duke's Day") when there is a big ceremony, and one of the Board addresses the Graduating Class. In order to inquire into things as closely as possible, and to distribute its work, the Board goes into some half-a-dozen Sub-Committees which

investigate the working of the different departments of the Academy. The officers of the staff, connected with these departments, appear before the Sub-Committees and give evidence at great length, stating freely what they consider to be their chief wants or defects. These statements are put into writing by the officers in letter form and are published *verbatim* in the Proceedings of the Board. It strikes one as rather curious that such prominence should be given to the opinions of subordinate officers, and the freedom with which they occasionally criticise the Government is calculated to produce a sensation of surprise in the mind of the English military reader. The Proceedings of the Board of Visitors, together with those of the Sub-Committees, and the numerous reports of the officers just alluded to, are published in the form of a book of some 116 pages, entitled the "Report of the Board of Visitors to the United States Military Academy made to the Secretary of War," it is somewhat verbose, and is full of repetition, nevertheless it contains much interesting reading, and is supplemented with very good maps, views, plans, and drawings.

Conclusions.

The West Point course is the most scientific training of the United States, analagous to the *Ecole Polytechnique* in Paris, and yet the requirements of admission are of the most elementary character, and do not amount to those required to enter an ordinary high school; hence the undesirable result that the extraordinary number of 50 per cent. of the cadets fail to graduate. At Woolwich if a candidate passes into the Academy the odds are, barring sickness and misconduct, about 20 to 1 on his passing out, but at West Point the chances are only even. It may be safely concluded that the great number of failures at the latter is due to the want of an open competitive entrance examination of a high standard. This is partly demonstrated by statistics, which show that a much larger proportion graduate of cadets who have undergone a local competitive examination prior to admission, than those who have joined on nomination direct. The figures are 63 to 37. No precise reason can be given here why open competition is not instituted, but it may be observed that the supply of cadets for West Point is less than the demand, and if the conditions of entrance were made more difficult, the supply would probably be still further diminished. A second reason might be that the American nation has not yet arrived at the stage of implicit confidence in the integrity of a public competitive examination. The question now arises, how do the other 50 per cent. of the cadets get through the West Point course? Some of them doubless may be young *savants* by intuition, but so far as is known, their intellectual stock-in-trade on joining the Academy consists of the three R's and a little History and Geography. How then at the end of four years do we find them past masters of mixed Mathematics, Philosophy, Physics, and many other branches of knowledge of a high order? The successful achievements of these cadets are probably due to good teaching falling upon "good ground," *i.e.* "industrious intelligence." The theoretical instruction, as now imparted at the United States Military Academy, is the result of years of experience

on the part of Professors and Instructors, and is the essence of all that has been found most valuable in the past; in point of thoroughness it leaves little to be desired. The large instructional staff makes the proportion of cadets to teachers comparatively small, and enables each cadet to get a fair share of the latter's time and attention. The division of the classes into small sections, in which cadets compete with each other, is an admirable device; and "Recitation" and "Daily Marking" make it difficult for them to idle in study.

The following extract from a London newspaper ("The Engineer") is given for what it is worth—reviewing a Treatise on Analytical Mechanics written by Professor Michie for the use of the West Point cadets, it says—"We wonder what the present Woolwich cadet would say if required to master this Treatise in a course of four months. To begin with he would not possess the knowledge of calculus which is presumed in the method of treatment of this book. How can it be explained that the mathematical standard of knowledge acquired at Woolwich is less now than 50 or 100 years ago, judging from the old 'Woolwich Course of Mathematics?' And, on the other hand, how is it that the American cadet at West Point, with all his multifarious subjects, can yet be taken to such a high pitch of reading as the present Treatise leads—as high as is now required for Cambridge mathematical honours?" The Royal Military Academy has, at any rate, nothing to learn from West Point in drill or discipline, and the former enjoys many advantages, such as the proximity of the Royal Arsenal and the School of Gunnery, also having the use of one of the best Riding Establishments in England, and being part of a large garrison, situated so that the cadets can see troops of all arms manœuvring at their very gates any day of the week. The West Point system which permits no holidays, no money, and no recreation would be intolerable to young Englishmen of 17 to 22 years of age, nor would any one, it is believed, desire to see it introduced in England. The organisation of the West Point and Woolwich cadets is very similar, but, other things being equal, the Academy which has an auxiliary in a staff of valued and efficient non-commissioned officers should benefit accordingly. A part of the West Point system which must attract attention is that cadets going into the Cavalry and Infantry have to go through the same prolonged and highly scientific course as those entering the Engineers, Ordnance, and Artillery. The question why this is thought necessary was asked by the writer on the spot. The answer given was that officers of the United States Army, whatever branch of the service they belong to, frequently found themselves in remote places where they were often thrown on their own resources for all kinds of information, and that, therefore, it was considered desirable to give them such an education as would render them quite independent, and place them in possession of every kind of scientific knowledge of which they might ever stand in need. This remark might apply with equal force to the British Army. The United States Army is a small one, and naturally the Americans want to have it a good one, but, according to our ideas, most people would consider a young man destined to lead the life of an officer in the Cavalry or Infantry would be better employed, for say the

last three years of the West Point course, learning his duty with his regiment, than studying Differential Calculus, Eclectic Physiology, Civil Engineering and the like at the Academy.

There are several other points it might be interesting to touch upon, such as the amount of money contributed by the parents of cadets towards the support of the Royal Military Academy and what it costs them, on an average, to prepare their sons for the entrance examination, and pay for their outfits, both as cadets and officers, also the comparative pay of officers in the British and United States Armies. The time and trouble taken by the West Point Board of Visitors might be favourably commented upon, but even if the Woolwich Board of Visitors were ready to follow their example it is not probable that they would spend their fortnight of inspection in a Woolwich Hotel! Space does not admit of further comparisons, so the writer will conclude by hoping, if he may be allowed to say so, that when any officer of the American Army visits the Royal Military Academy at Woolwich he will receive the same cordial welcome, and be given the same facilities for enquiry which were afforded to the writer when he visited the United States Military Academy at West Point.

HALIFAX, N.S.,
23rd May, 1892.

"I" TROOP (NOW "I" BATTERY), ROYAL HORSE ARTILLERY, AT THE BATTLE OF FUENTES D'ONORE.

BY

COLONEL F. A. WHINYATES, LATE R.A.

THE Regiment has always shown considerable interest in the circumstances connected with Captain R. Bull's Troop at the battle of Fuentes D'Onore, 5th May, 1811, when its 2nd Captain, Norman Ramsay, so distinguished himself by his dashing exploit on that day. It is strange we have no regimental record of the event, and only know of it through Napier's often quoted description in his "History of the Peninsular War." It has generally been assumed that the whole Troop was in this affair and was surrounded by the French cavalry. This I have always doubted because both Lieut.-Col. H. Framingham, who commanded the R.H.A., and Captain Bull, were present at the battle, as appears by reference to their services in "Kane's List." Had the whole Troop been cut off we may fairly assume Bull, who was in command, would have been with it, not being so, we must conclude it was but a portion, and, I think, it can be shown by good evidence it was a division, or two guns. About 60 years ago, viz., about 1830, there came out in the *United Service Journal* a series of papers entitled, "The British Cavalry in the Peninsula," as may be expected they give some information about the R.H.A. and as "I" Troop was always with the cavalry there is more, perhaps, about it than others. In the volume of the *Journal* for 1832, page 459, occurs the following account of what did happen to a portion of "I" Troop on the eventful 5th of May, 1811 :—

"By reference to the plate of the Battle of Fuentes in Colonel Napier's History, which is very good and clear, it will be observed that the River Turones and Nava-da-ver form a long plateau. The French cavalry having closed upon our side of Nava-da-ver made an impetuous charge on our picquets, and for a time were in possession of two of our guns, at least they were around the guns, and if the gallant Norman Ramsay had agreed scientifically he might fairly have accounted himself a prisoner. Such a thought never entered his noble mind, but heading his gunners he charged the enemy and cleared the

road for his guns.[1] The French, who, by-the-bye, most fortunately for us, were drunk,[2] came on at a rapid pace but in bad order, and were checked by different squadrons as they came up." The squadron which first came to the rescue was of the 14th Light Dragoons led by Brotherton, other troops joined, and the French Colonel, Lamotte, was taken prisoner. I think the above may be considered to give the real facts of the case, and though it may be disappointing to find the whole Troop was not present, yet I am sure it is best to know the exact truth, without which history is valueless.

[1] There is an apparent discrepancy with respect to the position of the "detachments" in this account and in that by Napier. The latter puts them in rear, the former in front. The probable explanation, I think, is that Ramsay when he charged the French cavalry had his "detachments" close behind him to open the way for his guns, having passed through the enemy he would likely enough drop them to the "rear" to prevent the French Dragoons riding up along side and interfering with his gun teams.

[2] It is not an uncommon thing to attribute daring attacks to the effects of drink, and, I believe, often most unjustly. It will be remembered that General Liprandi asked the prisoners taken in the Light Cavalry Charge at Balaclava "whether they were not drunk when they made so mad an attack."

FIRE DISCIPLINE; ITS NECESSITY IN A BATTERY OF HORSE OR FIELD ARTILLERY, AND THE BEST MEANS OF SECURING IT.

BY

MAJOR W. L. DAVIDSON, R.H.A.

"BIS DAT QUI CITO DAT."

COMMENDED ESSAY, 1892.

Definition of Fire Discipline.

The manual of Field Artillery exercises tells us what Fire Discipline implies, but lays down no limits to its meaning. Officers are taught at Shoeburyness that it is "now generally understood to be a combination of those qualities which enable the Commanding Officer to turn fire of any description, nature, and rate on any portion of the field at will." The definition given by Major Eden Baker, in the R.A.I. "Proceedings" of March last,[1] is evidently tentative. There is some truth, however, in his remark—"when this term is used, it is never safe to conjecture, that the writer or speaker includes in it exactly the same functions that someone else does."

Major Baker separates the "Fire Management" by the section officers, and the "Fire Control" of the commander, under the head of "Fire Tactics."

Both are included in Fire Discipline as applied to a battery of Horse or Field Artillery. Tactics is the science of manœuvring and combining on the battle-field the different military units. But now the Brigade Division is the tactical unit; and the Battery Commander has been relieved from tactical considerations, on purpose to enable him to concentrate his whole attention on the observation and control of the fire of his battery.

It is most necessary that the term should be authoritatively defined. As used, at present, it includes the process of training, and also the result of that training at any given moment. For the instructions for practice lay down that "before going to practice batteries can, and must be, exercised in the whole system of ranging and Fire Discipline as a drill." And credits are given, in the competitive practice, for Fire Discipline, *i.e.*, the results of training. Results alone tell on the actual field of battle, and depend on the state of Fire Discipline at

[1] March, 1891.

the moment. Without a fixed standard there can be no true comparison, nor uniform system of marking credits in the competitive practice.

In the dictionary the meaning of the word "discipline" includes education, instruction, rule of government, method of government, and punishment. It is doubtful if the sort of punishment permitted by regulation in the English Army ever has the slightest effect on men who are unable, or deliberately unwilling, to learn what is necessary. Terrible instances of the abuse of punishment in the German Army have lately come to notice. They are mentioned here simply as having evolved the most recent definition of "discipline" by a soldier of authority. In his despatch to the Reichstag, Prince George of Saxony declares that "True discipline, while severity and energy are maintained, is based on the fear of God, on education, on individual training, and on the development of the sense of honour." This has been proved over and over again in English history. Contrast the conduct of Havelock's "Ironsides" and the "God-forgotten" soldiers of John Company in the Indian Mutiny. Equally gallant under fire, the latter were not worth their salt, no matter what depended on them, if there was a chance of drink or looting. The former were sneered at as "Havelock's Saints." But their uniform good conduct elicited from blunt old Sale the characteristic aspiration :—"I wish to God the whole regiment were 'Havelock's Saints' for I never see a 'Saint' in the guard-room or his name in the defaulter's book."[1]

All these considerations help towards a definition of "Fire Discipline." To fulfil them it must combine a process leading to certain results and giving full play to the personal qualities, with a fixed standard of perfection as its aim. For the purpose of this essay it may be defined as :—The education and instruction of each individual, the rules and method of government of the whole battery best adapted to enable every man to act on the battle-field, even under the most trying and dangerous circumstances, with perfect obedience, intelligence, accuracy, and fearlessness, and to ensure such control and management of the fire of the battery as to obtain the best results from the weapon with which it is armed.

Its Necessity in a Battery.

It seems strange to modern ideas that anything need be written in proof the necessity of Fire Discipline. It appears obvious that officers, men, horses and harness, only exist in order to get their guns to the tactical point at the proper moment, and to shoot well when there. Yet the general recognition of this truth by the Regiment has been gradual and progressive. Even now it is not accepted in its entirety. Within the last three months Lord Roberts has said—"For some reason, inexplicable to me, it has not been the fashion in the Horse Artillery to pay so much attention to shooting as in the Field, Mountain, and Garrison Batteries. This traditional neglect of a most essential military requirement may have arisen . . . . . but, be the cause what it may, the fact is much to be regretted."[2]

[1] "English Men of Action. Havelock." By Archibald Forbes.

[2] Speech at Artillery Practice Camp, Delhi, 1892.

A study of the circumstances which gave rise to such a tradition, and the successive advances towards perfection in Fire Discipline will be of interest, and a valuable aid in proving its necessity.

The artillery of England has taken no part in European warfare since rifled guns and far-reaching shell, with accurate time fuzes, have become recognised factors in an engagement. Officers and men had been accustomed to short ranges, to guns served smartly enough, no doubt, but laid entirely at individual caprice. In 1857 a period of peace set in. The energies of all ranks were devoted to precision of drill and polish of turn-out.

In 1866 the breech-loading rifle revolutionised modern tactics, and the comparative loss of value in mobile artillery set men thinking.

Gunners began to study the reasons of this apparent deficiency in their arm. The results of this study were practically shown by the Prussians in 1870–71. Prince Kraft, in comparing the efficiency of their artillery in 1870 with what it had been in 1866, says : "I could never have believed that the instruction given in time of peace would have borne such excellent fruit in spite of the excitement of action."[1]

Batteries of English artillery were mobilised, and actually under orders to proceed to the Belgian frontier. The events of the Franco-German War were eagerly followed and discussed in England.

Admiration of the success of the German artillery gave a stimulus which the English artillery officers sadly needed. Individuals began working by rule of thumb, but there was no definite or uniform system. The Manual of Field Artillery Exercises of 1861, of 228 pages, does not contain one word of instruction in gunnery, except as to purely mechanical routine drill. The Manual of 1873 gives instructions as to laying, judging distances, ammunition and, still more important, an outline of course of instruction. This is the first real acknowledgment of the necessity of Fire Discipline.

In 1875 the importance of doing something to train the *personnel* was so successfully urged by a few leading artillery officers that a land range was secured at Okehampton.

Prizes for skill-at-arms were introduced in 1876, and a thorough and systematic course of instruction ordered to be carried out in each battery.

From this date a new era commences. The Regiment began to admit the necessity of Fire Discipline. But only by slow degrees. In 1877 Colonel Fox Strangways writes :—"If opinion in the Regiment were convinced that good shooting was essential to success in war, the greater part of the difficulty would be overcome."[2] In 1880 we read, "for some years past it has been gradually becoming apparent that the position, duties, and responsibilities of the junior regimental officers, must undergo an entire change in order to meet the altered conditions of modern warfare."[3]

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[1] "Letters on Artillery."

[2] R.A.I. "Proceedings," Vol. IX., page 406.

[3] R.A.I. "Proceedings," by Lieutenant A. M. Murray, R.H.A., Vol. XI., page 373.

NOTE.—The whole of this remarkable article bears directly on the subject of this essay, and the matter is as true and weighty now as when it was written.

The Gold Medal Essay of 1882 states that "still may be heard the echo of an earlier creed, it used to run—give your gunners good guns, good officers, and proper clothing, and British pluck will do the rest."[1] In 1883 we learn that "it seems difficult to believe that guns are laid on the same principles that ruled in the beginning of the century."[2] That this was the case no one can doubt who remembers the system on which batteries were brought into action and ranged at Tel-el-Kebir. "It was only in 1886 that the attention of the troops was, for the first time, specially directed to the necessity for a higher standard of Fire Discipline . . . . it may fairly be said that the main *desideratum* of the cavalry and artillery was to get back to barracks with a minimum of delay."[3] The term appears for the first time in the R.A.I. "Proceedings" in 1882. Colonel Pratt writes, "The main reason that the actual destructive effect of artillery in the field is so far below what it theoretically ought to be, is due to defect in Fire Discipline."[4]

This was the position of the pioneers in the Regiment when the translation of Prince Kraft's Letters appeared. His reasons for the failure of the artillery in 1866, and its wonderful success in 1870, became common property. The immediate demand for instruction dates from the publication of this correspondence.

The world knows not, as yet, the full effect that modern artillery may produce. With artillery "if superiority is established in the first few minutes of action, the issue is determined. The battery possessing less knowledge and training cannot even count on being able to retire."[5] The artillery that can crush the enemy's artillery fire has paved the way to victory. This is the object of all military affairs. The French possessed a long service army, and a superior arm, they were not inferior in numbers or resource. That they were beaten by the Germans was due simply to discipline in the highest meaning of the word, and the practical knowledge of their work shown by every grade.

The following conclusions may safely be drawn from the letters of Prince Kraft, and the experience of recent Continental wars :—

1. The training necessary to the efficient service of the present field guns in action cannot be given after taking the field.

2. Individual education alone will produce a state of discipline which will maintain steadiness in the fighting line.

3. Those only whose peace training has been complete and thorough can be relied on in the heat and excitement of battle.

Thus the lessons of the past point steadily to the necessity of Fire Discipline. They are confirmed by the teaching of the present. Lord Roberts addressed the batteries at Delhi as follows :—"I do not hesitate to impress on you the supreme importance of becoming thoroughly conversant with those technical details on which your military efficiency depends. I refer to the preparing and fixing of fuzes, the laying of

[1] Colonel H. A. Smyth, Vol. XII., page 127.

[2] R.A.I. "Proceedings," Vol. XII.

[3] Report of the A.-A.-G. for Musketry in India, 1891.

[4] R.A.I. "Proceedings," Vol. XII., page 278.

[5] Major G. S. Clarke, R.E., R.A.I. "Proceedings," August, 1891.

the guns, the service of ammunition generally, and, on the part of commanding officers, the observation of fire . . . . The possession of a superior force of well-served artillery would, in all probability, lead to victory. To ensure that this confidence in our branch of the service may never be misplaced, every available opportunity must be taken advantage of in peace time to make the service of the guns, not only as accurate, but as rapid as possible."[1]

Means of Securing Fire Discipline.

The means of securing Fire Discipline may be divided into :—

1. Those available within the battery.
2. Those external to the battery.

Means Within the Battery.

Carlyle tells us "there is nothing in the world you can conceive so difficult, *primâ facie*, as that of getting a set of men gathered together, rough, rude, and ignorant people—gather them together, promise them a shilling a day, rank them up, give them a very sharp and severe drill—for the word 'drill' seems as if it meant the treatment that would force them to learn—and there is the man, a piece of an animated machine, a wonder of wonders to look at. He will go and obey one man, and walk into the cannon's mouth for him, and do anything whatever that is commanded of him by his General Officer."[2] This, roughly as it is put, is the object in view.

The system laid down in the official manuals is admirable, and complete even to the number of hours to be devoted to each subject. Supplemented by the instructions for practice, just issued, it must be the foundation of all battery teaching. No power exists within the battery to subtract one tittle therefrom. It follows that the application and success of such a system must depend upon the personal qualities of officers and men. Some of these are natural, but all are, more or less, to be acquired. Some have, by instinct, all the habits of military foresight, which in others are the result of professional education and long experience. Unfortunately, no examination test can guage to what extent such qualities exist in any individual. For instance, almost, if not quite, the most valuable quality a battery officer can possess, is the faculty of getting the greatest amount of good and willing work out of those under him. Yet nothing can prove its existence but the experience of actual hard work and real difficulties.

The influence of the officers on the Fire Discipline of a battery can hardly be over-estimated. Both officers and men have lately developed a hearty desire for progress. This is much to the credit of the Majors, for it must not be forgotten that most of them began their career under totally different conditions from those which obtain at present. Such conditions exert a marked influence on a man's character, and it is no easy task to shake off habits and prejudices impressed on his, more or less, plastic nature as a young officer.

[1] Speech to batteries at Practice Camp, 1892.

[2] Address to Students of Edinburgh University, April 2, 1866.

The subaltern of to-day is somewhat apt to underrate the advantages which he enjoys, and it is good for him to know the sort of experience that his seniors went through. Thus he will learn to appreciate the higher aims which lie before him, and more thoroughly understand how loyally his senior officers, as a rule, have adopted the new teaching.

The Major.

When the present Majors of batteries joined the Regiment they found it permeated with the spirit of caste, so graphically described in "Prince Kraft's 7th Letter."[1] Their divisions were composed of old soldiers, many of them decorated with the Crimean or Mutiny medals, some with both. Such N.-C. officers and men were more adapted to teach a young officer than he to instruct them. The men who joined or left a battery in the course of a year might often be numbered on the fingers. Under such circumstances, it was difficult for subalterns to learn the rudiments of their profession. A ruinous standard of barrack-square efficiency was general, and every one was satisfied if this standard was outwardly attained at inspections. With such a system the importance of details essential to success in war is apt to be forgotten; and the natural indolence of the majority gradually lowers the conception of the amount of work which can be extracted from the men. The wave of German military views, which passed over England in 1871, contained sufficient volume of truth to sweep away most of the ideas these officers had been taught to cherish. One relic alone was left them of the old creed. It is still acknowledged that precision of drill is the easiest method of securing perfect personal control to the commander. But, apart from routine drill, a system of instruction had to be invented. The results of individual energy and initiative soon became apparent, but there was no uniformity in these results in different batteries. In 1872 came the introduction of short service, and the obligation it entails on every officer of teaching his men. Successive systems of instruction began to appear in the official manuals, lectures became more and more general, and now there is almost a danger lest training become too artificial.

On an emergency a complicated system will break down. Efficiency is a healthy growth, attaining real vitality in the open not in the forcing-house.

Mr. Darwin originated the remark, which has been endorsed by all military historians, that "mutual confidence" is the one quality common to the discipline of the present and the past. It is only where this exists, between the commander and all ranks, that Fire Discipline can attain perfection; and to ensure it he must have a real interest in the efficiency of his battery. Lord Roberts says, "When artillery officers think of the tremendous effect their guns may produce in the day of battle, provided their men have been taught to make the most of them, it is difficult to imagine their being satisfied with anything short of absolute proficiency."[2]

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[1] "Letters on Artillery."

[2] Speech at Delhi, 1892.

Without this spirit no amount of technical knowledge or smartness on parade will produce the same results. The interest must be real, it must be constant, and embrace everything connected with the battery and its *èsprit de corps*. This implies—unceasing patient effort to attain and maintain perfection in the many different departments of which a battery consists, constant training of the officers and N.-C.O.'s to bear the responsibilities of their particular *rôle*, making those responsibilities both thorough and clearly defined.

Foresight, common sense, and energy, are appropriate to the Major's routine duties; but it must be evident to his subordinates that he does not waste nervous energy on insignificant ends. He must have a thorough knowledge of detail, without the tendency to give so much attention to minuter errors, as to risk the well-being of the whole. In fact, he must fulfil Carlyle's advice, "Neither let mistakes and wrong directions—of which every man falls into many—discourage you. Let a man try faithfully, manfully to be right, he will grow more and more right. . . . . Study to do faithfully whatsoever thing in your actual situation you find either expressly or tacitly laid to your charge; that is your post; stand in it like a true soldier; silently devour the many chagrins of it, as all human situations have many." . . . . Study "what thoughts past men had in them—what actions past men did;" . . . . but remember that "a man perfects himself by work much more than by reading. They are a growing kind of men that can easily combine the two things—wisely, valiantly, can do what is laid to their hand in their present sphere, and prepare themselves withal for doing other wider things, if such lie before them."[1] Such are the qualities that make for Fire Discipline. If men are accustomed to find them in their commander during the routine of barrack life, they will take the field confident in him and in his power of responding to new exigencies.

The correct observation of fire and a quick eye for country are equally necessary. It is seldom in his power to obtain the practice required in the former. Hunting, shooting, and stalking are invaluable for teaching the latter. A good officer, who has cultivated the habit of observation, may improve himself, professionally, during a month's leave, more than in six months of barrack-square soldiering.

Gun Drill of the Battery.—Under the Major.

Gun drill should be assimilated, as much as possible, to service conditions. Every number must have his under-study. The commander himself should always have a "fighting-book" to record the targets, bracket, range, and length of fuze. Some signal, such as dropping this book, may be arranged to signify that he is *hors de combat*, when the command must be, at once, continued by the next senior. Section Officers should, occasionally, kill their active numbers, by a touch on the head or other signal; men can thus be taught to adapt themselves to any duty at a moment's notice. The accurate transmission of orders, correct intervals in "ordinary fire," and rapid switching on to fresh targets require constant practice. Carbine shooting is a great assist-

[1] "Letters of advice to a young man."—Carlyle.

ance in teaching young soldiers to lay. In firing with case, men must be trained never to run their guns up so long as the object is in view, and, as a rule, far too much time is expended on laying. The care of the gun-park with the 12-pr. and Mark II. carriage is of the gravest importance. The subaltern's report of "all correct" to the Captain, on every parade, is no matter of easy routine. It takes their constant attention to ensure that each round of ammunition is ready, and that all the complicated fittings are perfectly adjusted.

For instance, the brakes may be out of order, or the buffer not quite full of oil. The spare asbestos pads[1] should be constantly tested on the mushroom head; not only by the limber gunners, but by every number. It is not sufficient to rely on them as *spare*, they must also be *ready for use*. The fitting is so nice, that the least thing throws them out of gear, especially if the mushroom head were heated by rapid firing. Then it may be found that the clip-head spring will not close, or that the breech-block will jam in the bore, and the gun is useless! This constantly happens in the gun-park, but it would be a serious matter in the third stage of the fight! The service ammunition should always be brought up to the guns, and the gunners exercised in changing the contents of the boxes till the manipulation of every single article on charge becomes a second nature. There is no jump with the Mark II. carriage, and it is simpler to work in degrees and minutes, as the present scale of yards on the tangent sight is not correct. Nos. 2 should be taught to lay quickly for direction from the end of the handspike, especially with Scott's sights; and to traverse the gun so that the layer shall always find the target in the field of the sight. They are less likely to make mistakes, having the whole horizon in view; whereas the layer may find the wrong target through the telescope, and lay on it if pressed for time.

Captain and Subalterns.

Those qualities requisite in the commander are equally necessary in the junior officers; for at any moment the command may devolve on one of them. The Captain has few opportunities of practically learning his proper duty of supplying ammunition and replacing casualties in the field; so he must make it his business to study the theory the more thoroughly. He should be responsible for the condition of those carriages and stores required on mobilisation. The responsibility of Section Officers must be acknowledged absolute and direct. Results are what are wanted; ways and means may be left to them. Reality and energy in their own work will secure application in their subordinates. To make good men, or get good work, they must give responsibility to individuals.

But the individual must first be thoroughly trained in his own sphere. The confidence of their men is only to be gained through work. Spasmodic efforts will not obtain it. Nothing is more dangerous than sudden inroads of smartness. Tact must be combined with discipline. The Duke of Wellington says, "In a young officer discipline must be

[1] A case is known where by simply scratching the covering with the finger nail to remove a little grit the pad became useless.—(5th edition "Questions and Answers 12-pr. B.L.," by a Major, R.A.)

combined with letting his men feel that in him they have a companion, friend, and adviser." No man should join or leave a section of a battery without a personal interest being shown in him by his Sectional Officer. Individual characters must be studied, and instruction adapted accordingly. The more a man is interested in his work the better he will do it.

Lectures.

An excellent outline of lectures on gunnery is given in the "Manual of Field Artillery Exercises." Subalterns who have sufficient zeal and talent to fill in this outline, with matter of wholesome interest to the men, will soon raise the standard of Fire Discipline in their batteries. A high ideal must be kept up. This is the only way in which men can be taught the spirit of devotion to duty on which a battery must rely in times of difficulty. Many of the minor episodes in Prince Kraft's Letters ensure breathless attention; and the story of the "One Year Volunteer Klopsch," well told, may have valuable results at practice. Soldiers in the present day are anxious to learn, keen to get on, and easily influenced. Fire Discipline requires that the fighting instincts and military qualities of each one should be developed to the greatest possible extent. It is equally important to cultivate the moral faculties. Self-control, self-reliance, intelligence and self-respect, are essential to the common end. Self-respect, above all, makes men truthful and loyal; armed with self-respect a man will not prostitute his work to a lower level than his best. Much may be done in this way to kindle *èsprit de corps* and raise the moral tone among men. For this purpose Smiles' books on "Character" and "Self-Help" supply many useful anecdotes; and it will repay any officer to study and adapt to battery requirements a paper on "The Training of our Recruits," by Colonel G. Hatchell.[1]

Indeed, it is fatal to Fire Discipline that men should not be instructed in what is likely to happen in action. Most officers have some idea of shells bursting all about, of officers, men, and horses dropping under an enemy's fire; but on this subject the mind of the ordinary gunner or driver is, more or less, a blank. Admiral Sir Geoffrey Hornby writes:—"When men know and trust their leaders and comrades, and are thoroughly aware of the sort of danger they are likely to incur they are no longer to be startled, but will go quietly and resolutely into action as they would to a parade."[2]

And he instances a well-known trait of English character: "At the first moment of a mine explosion the miners will run; but immediately after, though they are well aware of the danger, should volunteers be called for to descend plenty are to be had, and even men who have just escaped will return to confront any risk."

Short and well chosen stories of what has happened in war, such as "Mercer's Battery at Waterloo," or Major Parsons' account of the "Ingogo River," will raise the character of soldiers and stimulate their fighting instincts.

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[1] "The training of our Recruits."—Colonel G. Hatchell, "R.U.S.I. Journal," September, 1891.

[2] "The War Training of the Navy."—"U.S. Magazine," September, 1890.

To Induce the N.-C.O.'s to Lecture.

By sketching the outline of a few simple lectures and encouraging the senior N.-C.O.'s to deliver them, a subaltern will improve both teachers and pupils. He should himself generally be present at these lectures, and induce the latter to ask questions freely. Such teaching gives N.-C.O.'s a much greater interest in the proficiency of their men; and men learn increased respect for, and confidence in their N.-C.O.'s. The more interesting such lectures are made, the more they will be regarded as a welcome change from the monotony of marching or standing gun drill. Little real progress is made in these drills in very cold or wet weather; but in this way any afternoon may be turned to profit. In the present state of the Regiment it is not too much to affirm that a series of short, well thought-out lectures on professional subjects, in addition to the regulation drills, is one of the best means of securing Fire Discipline in a battery.

Recreation.

In the artillery the work is so constant in the open air that bodily health is pretty well secured. The work is often hard, and for this reason, if not required for parade, men prefer to rest in their barrack-rooms, unless recreation is made both popular and convenient. This is a point young officers are apt to forget, and they are too ready to be discouraged at the difficulty of getting up a match among the men. Anything, however, that assists the development of the physical powers and dexterity of soldiers is of value. This is the basis on which rest that individual nerve and self-reliance which result in love of enterprise, endurance in the field, and mobility in manœuvre. If a good eleven can be got together in the battery, so much the better. Great fun may be obtained by getting up duffers' matches when work is slack. Occasional flat races, or games of rounders, give recreation both to the performers and lookers on. The development of foot-ball has been a distinct gain. Men in a battery often know very little of one another, and these outings do much to increase the feeling of *camaraderie* which should pervade all ranks. Such exercises develop habits of good order; they require control of temper, and without truthfulness they could not be carried on. They also promote the love of fair play, and appreciation of pluck; and they stimulate generosity of mind.

N.-C.O.'s.

The non-commissioned ranks are the backbone of Fire Discipline in a battery. N.-C.O.'s have made such strides in technical knowledge of recent years that, after having been to Okehampton and Shoeburyness they are apt to under-estimate the difficulty which some recruits find in understanding the simplest terms in gunnery. If not guarded against, this is a very real danger. Terms, such as percussion fuze, line of sight, recoil of carriage, &c., convey their meaning at once to the brain of most N.-C.O.'s. Many recruits, however, with the best will in the world, never really understand them till they have seen a gun fired with a service charge. No system which ignores the weak-

nesses of human nature will answer. Much allowance must be made, and patient explanations given. In these days of general education, a sergeant can only keep ahead of his men by reading up his profession;[1] he must prove to his sub-division that he is fit to be their leader in any emergency. His constant business is "to give subtilty to the simple, to the young man knowledge." He must study the individual characters of *all* his men, but more especially of his layers. On them, in a great measure, the Fire Discipline depends, as without uniform laying any attempt to fight a battery as a whole must fail. The sort of intelligence required to pick out a target quickly, set scales, &c., is not always combined with a quiet temper. Their demeanour must be closely watched on critical occasions, and a judgment formed of the probable accuracy of their actions. Men often fail absolutely at competitive practice who are first-class in the barrack-square. It has been proved over and over again that one man, by bad laying, can ruin a whole year's practice under ordinary peace conditions. It is a great step in the right direction that the Commanding Officer is allowed to take such matters into consideration when awarding prizes to gun-layers.[2] He can trace the error to a particular sub-division by a careful comparison of each round with the relative range; making allowance for the "gun rectangle" at that range. A sergeant who takes a proper pride in his sub-division should constantly impress these facts on his gun-layers, and the tremendous importance of coolness in all who may have to lay guns in the field.

N.-C.O.'s should never forget that their example has the greatest influence on the young soldiers who compose the majority in a barrack-room; this is a real responsibility. The career of many a man depends on the circumstances which surround him on first joining a battery. If he finds professional zeal and a good tone, he will soon conform himself to both.

Many difficult and irksome duties have to be faced during a N.-C.O.'s service. In order to gain that respect from his men which is necessary to Fire Discipline he must never show a sign of wishing to shirk a duty however humble it may appear, and always bear in mind that "He that is soon angry dealeth foolishly, and a man of wicked devices is hated."

Signalling and Judging Distance.

Anyone of the intelligence of a N.-C.O. can teach himself the morse alphabet in a very few days sufficiently to be able to read and send simple messages. It is always possible that, on service, the ability to do so might be of great importance to himself and others. Many of our stations give few opportunities of teaching N.-C.O.'s to judge distances. Route marching should be freely utilised for this purpose. One would be astonished at the wild guesses made by men before some education has been given on this point. Many of the rank and file cannot tell how many yards there are in a mile or a furlong.

Before an artillery N.-C.O. can be of much use as an instructor he

[1] A manual for N.-C.O.'s has just been published officially.

[2] Instructions for Practice, 1892.

should be able to make a fair estimate of the distance to any prominent object within two miles. Nos. 1 can do a great deal to educate themselves in this and in map reading; their men soon become interested in the subjects, and it is curious to see what excitement is caused in pacing the distance on the spot, or measuring it on a map. These occupations lighten the tedium of the march, and raise wholesome subjects of conversation.

Men.

The men, with very few exceptions, are fairly educated, and excellent material. Every encouragement should be given to induce self-education amongst them. It costs little, for instance, to hang up boards containing the morse alphabet, or a few simple gunnery rules, in every barrack-room. The progress in Fire Discipline entirely depends on their officers and N.-C. officers, subject to the local advantages or disadvantages of the station in which the battery lies.

Means External to the Battery.

The influences from outside, which affect Fire Discipline in a battery, are so numerous and differ so widely both in their nature and importance that an essay like the present can only touch the fringe of the subject. Almost every suggestion towards efficiency in the English Army resolves itself into a Treasury question. The artilleryman and the Treasury, unfortunately, regard each from diametrically opposite points of view. Yet, in many cases, the intelligent tax-payer would side with the gunner if the broad facts were laid clearly before him. The common sense of the country is not dim, and grasps the importance of having its small force of mobile artillery perfect both in *personnel* and *matériel*. Relying on the truth of the proverb, "There is that scattereth and yet increaseth; and there is that withholdeth more than is meet, but it tendeth to poverty," the Germans are in the act of spending £3,500,000 in order to develop their Field Artillery.

Competitive Practice.

General Nairne's Prize in India led the way. The new system of competitive practice and prizes for skill-at-arms has been a great step in advance. Forty-four batteries (putting aside the 7th Field Battery, which seems to have been unfortunate) competed in 1891. It is a remarkable fact that the credits for Fire Discipline vary very slightly as compared with the total points.

The first battery, in order of merit, fired 137 rounds and obtained 328 points for results on the targets. The 44th on the list fired 70 rounds and made 24 points on the targets. The latter, however, was superior in Fire Discipline! It is credited with 50 marks, against 45 gained by the former. Two batteries obtained full credits (60) for Fire Discipline, but the results (216) and (190) of their firing only place them 13th and 17th on the list, one qualifying for a second, the other for a third prize.[1]

The first nine batteries average 47·6 for Fire Discipline, the last eight 45·7; which does not seem to tally with the enormous difference

[1] "Summary of Competitive Practice."—R.A.I. "Proceedings," January, 1892.

in fire power, or the remark made in reference to the latter batch—"there must be something very wrong in the training and command of a battery to lead to such a serious defect in a vital point."[1] To judge from the summary of competitive practice, the six Horse Artillery Batteries from Aldershot and Woolwich are superior in Fire Discipline to the first prize batteries from Newbridge. But they failed in fire power, and to qualify for a prize. The number of dummies disabled in a series may depend on many variable conditions of range, light, weather, and luck, apart from accurate laying and observation of fire. At Okehampton, especially, there is little difference, so far as shooting is concerned, between a battery that scores 320 and another scoring 250, on the sort of targets used in the series. That the 58th Field Battery (which thoroughly knows the ground, and "is noted for its proficiency in rapid and accurate shooting"[2]) only scored 190 on the targets, pretty well proves this fact. Taking the figures for last year the 49th Field Battery heads the list, but if the maximum for Fire Discipline were raised to 400, the order of merit would run :—

		Credits.			50% allowance.	Fire Discipline.	Total.	Order of merit in 1891.
		Series 1.	Series 2.	Series 3.				
1	62nd Field Battery	92	30	60	91	386	659	8th.
2	66th " "	80	52	54	93	373	652	6th.
3	80th " "	168	62	86	—	333	649	2nd.
4	67th " "	104	62	80	—	400	646	13th.
5	49th " "	152	86	90	—	300	628	1st.

A consideration of these facts seems to point to the conclusion that the credits given for effects on the targets are too high compared with the marking for Fire Discipline. The element of luck may tell considerably in the former, but never in the latter, if the judging is uniform. This year the maximum has been increased to 100. This does not appear sufficient to counteract the element of luck, and "adequately discriminate between the various shades of excellence to which the batteries have been worked up."[3] It appears unsatisfactory that a battery which is credited with only three-quarters of full marks should head the list. Good shooting must always be a *sine quâ non*, but if Fire Discipline is to be secured it must be made the prominent feature in the competitive practice of the future.

System of Command.

It is impossible not to be struck with the fact that the shooting of

[1] Para. 58 "Instructions for Practice, 1892."

[2] "Experiences at Okehampton in 1891," by Captain W. L. White, R.A., R.A.I. "Proceedings," January, 1892.

[3] "Experiences at Okehampton, 1891," by Captain W. L. White, R.A.

the batteries from the larger stations is not good. Only one out of 10 batteries from single out-stations failed to qualify for a prize. Nineteen out of 24, from those stations where more than two batteries are quartered, did so fail; and only one first prize was secured amongst them. In such places many things militate against preliminary instruction. The distances to the gun-parks and drill grounds are greater, and also the number of men that are employed, and out of the Major's reach. There is seldom any ground close to barracks where laying, signalling, and range-finding can be carried on in spare moments.

This raises the question of administration, and the local opportunities that are given to batteries.

Colonel Maurice, after repeating Prince Kraft's maxims that artillery must (1) be able to hit; (2) be in a position to come into action at the right moment, writes:—"It depends far more, in England, upon Generals commanding districts and divisions, and on their staffs, than upon artillery officers whether this result is attained or not. It is almost impossible for the most zealous artillery officer to keep up the confidence and spirits of his battery, and to keep their work to the proper level, if on every occasion they find that, because he insists on work being properly done, some other battery which is amusing itself with sham firing gets all the credit of superior smartness."[1] These are grave words, and pregnant with influence on Fire Discipline.

At Aldershot, Sir Evelyn Wood, and the senior regimental officers, have assimilated all artillery movements but actual battery drill to service conditions. Except for the "Grand Parade," brigade drill is practically abolished. Batteries have opportunities of teaching their drivers to make long steady advances into the preliminary position, to avoid exposure in bringing their guns into action, to place their limbers under cover, and to limber up from a distance with rapidity and without confusion. But there is reason to fear even so much is not done at other large stations.

Woolwich, the head-quarters of the Regiment, is most generally known, and may be taken as an example. Six service and six depôt batteries are quartered there at present. All mounted drills must take place on Plumstead and Woolwich Commons, or on the public roads. It is improbable, owing to the price of land, that a much larger area will ever be obtained. It is difficult to see how the excellent advice of Lord Roberts can be carried out, "At every drill parade of the battery or brigade, one or more positions shall be taken up for coming into action under service conditions, with regard not only to the selection of the position and the manœuvring of the batteries up to them, but to the carrying out of all details. Shells and cartridges should be brought up to the guns, fuzes bored and set, the guns accurately laid, puffs of powder burned to test observation of fire, &c."[2] Yet it applies as much to the Common as to the Maidan.

From October till May there is no single place where a wheeled carriage can be driven into action and the guns fired with blank; or

[1] "Essay on War," by Colonel Maurice, R.A.

[2] Speech at Delhi, 1892.

where observation of fire can be practised with petards. In spite of all this, the preliminary training of batteries for Okehampton must be got through, somehow, by the end of May. Something must be done!

It would seem possible, for instance, to send the batteries of a division each to some place five or six miles from barracks, with orders to start from thence at a given time, *rendezvous*, advance up the Common into the preliminary position, and come into action. The men like an outing on a fine morning, and the horses would be hardened for the march to Okehampton or manœuvres at Aldershot. It would also clear the Common of three batteries for the greater part of the morning; and a march past and inspection, after such a trial, would test the condition of the horses, the fitting of the harness, and the way the kits are put on, much better than if the batteries had just turned out of stables.

A narrow platform across the top of the Common, north of the Camp stables, might be metalled and gravelled like a barrack-square. It would not be more unsightly than the *manèges*. In this way many fine mornings in winter could be utilised. Two or three guns, with their limbers and wagons, might be dropped there, while the horses were being exercised on the roads, and their detachments given much profit in laying (both direct and with auxiliary marks), handling of ammunition, and general duties. Signallers and range-finders could be exercised under the eye of an officer, and instruction given in the use of the telescope and Scott's sights. The position lends itself to all this, and also to firing with blank, while petards might be puffed on the barrack-field to teach observation of fire and height of burst. The officers could acquire the habit of lucidly describing targets to be laid on; and men would learn, not only to pick them up quickly, but to lay on the very targets they would find in the field, as constant opportunities occur of laying on the guard mounting, exercising order, or a regiment or battery route marching. Short courses of N.-C.O.'s could thus be taught everything, as well as at Shoeburyness, with the exception of actual firing with the service charge.

These are mere suggestions, made with all deference, but deliberately put forward as instances of the direction in which the Regiment must move if Fire Discipline is to be secured.

Drill Sheds.

It would be an economy to build drill sheds, well lighted, and with lecture rooms, containing models and drawings of the guns, carriages, and ammunition, in our large stations. Money is wasted, because time and energy are squandered through the want of them. At Woolwich, a constant stream of some 2000 young fellows is passing through the depôts to service batteries. The means of training this body are absolutely inadequate. In every battery there are a few men genuinely anxious to get on, and interested in their profession for its own sake; in a large station there may be many such. They form a valuable nucleus; but, at present, too little encouragement is given to voluntary efforts. The advantage of a place where they could examine models, read up manuals, and practice signalling or firing with Morris tubes,

in their spare evenings, would not only be appreciated by them, but be a real assistance towards Fire Discipline.

Garrison and Other Employments.

The administration can help Battery Commanders enormously. One of their chief difficulties, in a large station, is in getting hold of their men. There are so many fatigues, guards, and garrison employments, that it takes the remnant of a battery their whole time to groom the horses and clean the carriages and harness, especially during the drill season. Batteries might, in turn, be entirely relieved from such duties for a week or a fortnight at a time; and more attention might be paid to Lord Wolseley's suggestion that "it is to be hoped that all bits, chains, stirrup and other iron work, over which hours are now uselessly spent in burnishing, may in future be either nickelled or lacquered. . . . . The time squandered daily in this folly would suffice to teach him much that he is ignorant of, but which is essential to his efficiency."[1] If this were done our small drill grounds could be utilised for the greater part of a summer's day, instead of only from 9 a.m. till noon.

Lord Wantage's Committee suggests that all permanently employed men should belong to the Army Reserve, and be in excess of establishment. This would ease the work and give opportunities of thorough training to all ranks. Nothing would do more for Fire Discipline than an increase of, at least, 18 gunners and 12 drivers to the present establishment of six-gun batteries. The Horse Artillery, if mobilised at present, have no spare trained drivers, on whom the Captains could rely, for their first and second line of wagons. It is impossible to read the general rules for the supply of ammunition in the field,[2] without recalling Prince Kraft's remark, "it is not then sufficient to wish that masses of artillery shall be brought up in time, it is necessary also to have learnt and practised the manner of doing it."[3]

At Woolwich, a well-considered system of attaching men from the congested Field Depôts to service batteries,[4] would have the same effect, and be of advantage to both. It might be unpopular in the depôts, but the end to be considered is the efficiency of the whole. In this way most of the gunners and more intelligent drivers from the depôts could be thoroughly instructed in 12-pr. gun drill, and the means of securing Fire Discipline in service batteries improved by their assistance in stables, and the increased responsibility thrown on N.-C.O.'s of constantly drilling large squads.

The Staff of the Brigade Division.

This leads up to a point of vital moment. Most distinct and important duties are laid down for the Adjutant with regard to bringing the batteries of a division into the preliminary position, pointing out the spot where the limbers and wagons are to remain when the guns

[1] "Soldier's Pocket-Book."

[2] "Instructions for Practice, 1892."

[3] "Letters on Artillery."

[4] As laid down in "R.A. Standing Orders," Sec. XLV., para. 14.

are in action; in addition to which he is the vehicle for the transmission of orders from the Lieut.-Colonel.

But, at present, he may be a Captain or subaltern borne on the establishment of one of the batteries of the division. The Fire Discipline of his battery must suffer, especially if he happens to be a Captain, as it has no guarantee for the supply of ammunition. If the Brigade Division is to be the tactical unit, it must be complete in itself, and have its staff of Adjutant, Quarter-Master, Staff-Sergeants, and Gunnery-Instructor. Recruits join batteries in driblets, but if this arrangement were adopted they could be put through uniform courses of marching, riding, gymnasium, sword, carbine, and recruit's gun drill in larger classes, under divisional arrangements. This has proved a success in the French and German Armies, where the recruits all join on the same day, and obtain uniform preliminary training, uninterrupted by fatigues.

Discharge of Worthless Soldiers.

Officers commanding divisions should be given greater facilities for discharging men of bad character, or insufficient intelligence. The present system of drafting the bad characters from the depôts to service batteries[1] is most injurious to Fire Discipline. They are usually drivers, very young, and quite unfit for the hard work required of them. In many cases this tends to crime and disgust with the service, and they either desert or go to prison, thereby throwing increased work on the already attenuated establishments.

There are not many of them, and it would have a most wholesome effect if they were summarily discharged, and the batteries kept up to strength, especially in the Horse Artillery.

Inducements to Self-Improvement.

Two suggestions of Lord Wantage's Committee affect the subject of this essay:—

1. That all Acting-Bombardiers should have extra pay.
2. That deferred pay should be done away with in its present form.

There is not enough inducement to men to work hard to qualify for an acting stripe or as a first-class gunner or driver. No difference is made at present between a keen intelligent man and a lazy slovenly fellow, so long as the latter steers clear of the defaulter book. The system of paying men extra, according to their proficiency, has obtained the most valuable practical results in the R.E. and A.S. Corps. It would be a really good bargain for the country if the £21, at present earned as deferred pay at the end of seven years, were distributed as follows:—

Not less than £5 retained as a lump sum to be given on a man leaving the colours after three years' service, or more.

The remainder used so as to allow—

1d. extra per diem to be paid to men on being rated 3rd class.
2d. „ „ „ „ „ „ 2nd „
3d. „ „ „ „ „ „ 1st „

[1] "R.A. Standing Orders," Sec. XLV., para. 26.

If men fail to obtain these ratings, say, in—

1 year for	3rd class.
18 months for...	2nd „
3 years „	1st „

What remains of their 3d. a day should revert to the country. A man should be given every encouragement to save by his own exertions while in the army, and he would not be so likely to squander money on going to the Reserve if he had put it by himself. In this way increased efficiency would be combined with the advantages of the present deferred pay system.

Signalling.

Signalling is constantly required in the field and at practice. Signallers ought to be paid and wear badges, as in the Garrison Artillery and regiments of the line. Lord Wolseley says, "We are very mean in all such matters, but to make the men pay for badges, which we consider should be allowed in the true interests of the army, would be to surpass our previous record in this respect . . . . any additional signalling equipment that may be considered necessary should also be supplied at the expense of the public." [1]

Manual of F.A. Exercises.

The Glenbeigh report points out that the manual requires correction in the orders for re-loading, words of command and rates of fire. These are not alluded to in the "Instructions for Practice for 1892." A test in laying with auxiliary marks might be introduced with advantage into the examination for layers,[2] and the present gunnery paper could be made more practical. The senior N.-C.O. of a sub-division should not be an active number, but command his detachment and supervise the supply of ammunition. The carriage recoils so far that, with rapid firing, an extra hand is needed to run up, or the men, and especially the layers, soon get exhausted, and the shooting becomes wild.

The Sergeant could assist in this way, while keeping a check on the ammunition expended, seeing to its renewal, and the replacing of casualties; besides having everything prepared for an advance, if ordered.

Land Ranges.

More land ranges are required; each should have an instructional battery in order to test all new inventions in guns, carriages, or ammunition. This would be an economy. There is sound wisdom in Captain Acland's remark, "I am no believer in the work of Committees, nor of draughtsmen, until their labours have been purified by passing through the ordeal of criticism of practical though possibly less scientific artillerymen." [3] For example—Mark II. carriages were

[1] Report of Practice at Glenbeigh, 1891.

[2] No distinct instructions can be found whether layer's prizes are to be given for laying alone, the preliminary examination, or the total of preliminary and written combined. The want of uniformity in different batteries last year caused much dissatisfaction among the men.—Appx. to R.O. 33 of 1890. Compare Army Orders of 1st April, 1891.

[3] "Discussion on Experiences at Okehampton."—R.A.I. "Proceedings," January, 1892.

issued in large numbers in a very imperfect state. This gave a distinct blow to Fire Discipline.[1] All the alterations since found necessary would have suggested themselves to practical gunners. This would have saved the country much expense. The higher the technical education the more valuable will be the confidence placed in the *matériel* of a battery; and the more prejudicial will be any suspicion of weakness in the carriage, or uncertainty and want of proper effect in the ammunition. Mechanical perfection will never make up for the want of Fire Discipline, though it may be a great assistance towards it.

Improvements in Matériel.

This is not the place to go into the questions of "high muzzle velocity," and the margin of strength required in a field carriage. Yet it is the fact that the Horse Artillery find it impossible, with the present gun and carriage, always "to be in a condition to come into position at the right moment." And this from no fault of men or horses, but simply that, against practical experience, too much is demanded from the latter. The experiences on the Berkshire manœuvres, where they could not keep up with cavalry, though carrying *no ammunition or limber gunners*, have been intensified by the latest accounts from India.

"Not one shot was fired by the R.H.A., who were busy extricating their teams and guns from the pitfalls they had encountered . . . . the much vaunted Horse Artillery could make no better hand of it out here than its representatives at the Berkshire manœuvres did . . . . on the whole good-going; yet not once could the gunners get their guns to the front of the trotting line they started with. Whips were used unmercifully as it seemed, and men and horses strained every nerve to sustain their great reputation . . . . but to no purpose."[2]

If this is true it tells against Fire Discipline, which demands simplicity and a large margin of safety in the carriage, combined with no greater weight than will permit of the gun being brought, by six horses, to the point required by tactical considerations at the proper moment.

Ammunition.

The results on the targets produced by the Swiss artillery raise the hope that inventive science will supply a projectile to supersede common shell, and unite facility of observation with man-killing effect. A simple system of giving elevation by a graduated wheel and indicator

[1] The history of six of these carriages has been carefully verified. They were issued new from the Arsenal in November, 1890, to a Field Battery which practised at Okehampton in 1891. The collars were very stiff at practise, and oil holes were made on the top of two of them by the battery artificers. They were handed over to the R.H.A. in August, 1891, after the return march from Okehampton. Four guns were immovable and would neither be elevated or depressed. After dismounting the guns soaking in oil, and heating the collar, they were still unserviceable. They were sent to the Arsenal, the collars replaced by rings, oil holes bored in the top, and ostensibly placed in thorough repair. However, none of the brakes were to be depended upon. They were sent for again by the Carriage Department, and were in the Arsenal from 13th November, 1891, till 12th February, 1892; the traversing gear was removed, and the carriages presumably over-hauled. The brakes are still unreliable. How would this do on service? It must tell against Fire Discipline. Even in peace time it is serious that a battery should have no guns mounted, in order to train their men, for more than three months out of seven.

[2] "Letters on Cavalry Camp of Exercise."—*Army and Navy Gazette*, 23rd January, 1892.

would facilitate ranging. It would also be a great advantage if shells could be carried ready fuzed in the limbers, as in Germany; and if the fuzes were mechanically clamped so as to be ready for use, without further adjustment, against a sudden attack of cavalry.[1] The only reason given for graduating the time and percussion fuze to zero is that the supply of case might run short. In savage warfare the number could easily be increased; 12 per gun were carried in Zululand. In European warfare it does not seem valid, "For during the whole of this war (1870–71) the batteries of the Artillery of the Guard expended about 25,000 shell and *one case shot. And the latter was broken in transport.*[2]

Practice Camps.

Officers and N.-C. officers have few chances of actual practice on land ranges; the majority of gunners only have two such opportunities during their whole service! No amount of reading or instruction fulfils the same purpose. Correct observation of fire can be taught in this way alone. The smaller scales of ammunition are not sufficient to teach a battery, to borrow words again from Lord Wolseley, "It strikes me as the silliest of false economy to provide our Field Artillery with a splendid gun like the 12-pr. B.L. and to refuse the amount of ammunition required to make the men and officers in those batteries thoroughly efficient in the use of those guns."[3] The supply of ammunition in the field must be taught. This can only be done at camps on land ranges, where enough horses and double lines of wagons should be kept to complete each battery during its stay. No one can fail to be struck with the interest men take in practice at Okehampton, where their training goes beyond the dry details of theory into real work and practical results. This is the feeling that must be developed.

The *matériel* has improved, the technical training of the *personnel* has advanced by leaps and bounds, but the means of taking the full advantage of these developments have diminished! The very excellence of our present weapon has told against Fire Discipline. It ranges so far that, at present, Okehampton is the sole inland training ground.[4]

It is now fourteen years since Colonel Hastings wrote, "The system is an excellent one. It enables a Commanding Officer to thoroughly instruct his men in every nature of fire under such conditions as would actually occur on service, and, at the same time, tends to increase his own technical knowledge and tactical skill in handling a battery in the field. In 1878–79 nearly *two-thirds of the whole force* of Horse and Field Artillery will practice, with a considerable increase of the ammunition, over the new land ranges of Okehampton, Hay, Aldershot, and New Romney, and *in each succeeding year a like proportion.*"[5]

Who is responsible that this reasonable prophecy is not fulfilled? The best means for securing Fire Discipline remain in his hands. *Bis dat qui cito dat!*

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[1] "Instructions for Practice, 1892," para. 34.

[2] "Letters on Artillery."

[3] Glenbeigh Report, 1891.

[4] The Barrie Links have now been purchased.

[5] Report of Commandant of School of Gunnery, 1878.

ACHIEVEMENTS OF FIELD ARTILLERY.

BY

MAJOR E. S. MAY, R.A.

PART III.—Chapter II.

The Transition Period.

The next occasion on which artillery was opposed by hostile guns, under conditions such as might lead us to draw valuable and trustworthy conclusions from its action, was the campaign in Northern Italy of 1859. But with reference to it we are confronted with an insuperable difficulty. In the first place the armament, as regards artillery on both sides, were by no means equal, for whereas the French guns were rifled, those of the Austrians were not. Conclusions drawn from the premises afforded by such a state of things are not of value, nor need artillery claim credit for achievements effected where the conditions under which both sides fought were not the same.

Moreover, although at Solferino the French artillery did excellent service and were handled in the orthodox fashion, impartial observers do not even here report their effect as destructive as it might have been. Major Miller[1] says that although the new rifled cannon was said by the French to have produced magnificent results, the Austrians did not endorse the story, and that their real power could hardly be observed in the first battles. At Solferino their effect was marked, but their fuzes acted badly, and the results were thus diminished. Taubert on the other hand criticizes the manner in which, at Solferino, the Austrian guns were handled. No combined effort was made, their reserve of 100 guns never fired a shot, and out of 800 pieces on the ground, but 360 were brought into action.

Nor does the French official account[2] speak with much enthusiasm of what their artillery achieved. At Majenta[3] it is stated that General Auger so shattered the centre of the Austrian line with a battery of 40 guns that he prevented their reforming, and that the columns hastened to get beyond the scope of his searching fire, while at Solferino we read of guns correctly handled in masses and taking their due share in the fighting, while the single Austrian batteries which attempted to engage them were destroyed. But we hear of no brilliant blows, no headlong enterprise, and no splendid results. The

[1] "A study of the Italian Campaign of 1859," by Major Miller, R.A.

[2] "Campaigne de l'Empereur Napoleon III. en Italie, 1859."

[3] Miller throws doubt on the authenticity of this achievement.

French guns over-matched the hostile artillery by their greater precision and range, and they deserve the credit due to those who have done what has been required of them. But their superiority in *matériel* rendered anything heroic unnecessary. Therefore it is that we pass over this campaign, and look to another shortly to break out in the New World for our next illustration.

The deductions which have hitherto been drawn from the American War have had reference rather to the employment of mounted infantry, the value of entrenchments, or the effect of sudden swoops of raiding cavalry, than to the deeds of artillery. The feats performed by the arm have indeed, in more than one quarter, been disparaged, and have, except in America, been almost always ignored. Unjustly so, however, as we believe. It was not to be expected that without experience in handling large masses of the arm, with gunners but poorly trained, and officers in many cases new to their work, and, above all, on the Federal side at least, hampered by the vicious system of organisation forced upon them by the War Department, the leaders on either side could at once utilise the arm to the best advantage, or develop its capabilities to the fullest extent, but as the war went on its value was more appreciated, and instances can be brought forward to show that it was turned to account in a manner worthy of the great masters on this side of the Atlantic.

The same cause which was largely responsible for the lack of combination in the handling of our Field Artillery in the Crimean campaign was also at the root of the failure of the arm, especially on the Federal side, during the earlier days of the war. The command of the artillery in the Crimea was not invested with all the independence and authority which was desirable, and the arm was regarded rather as an appendage to infantry units than as an arm capable of independent action, and most likely to achieve great results when so regarded. Without wandering into any side issue unnecessarily, it may be briefly stated that the canker which was at the root of our artillery system of forty years ago was the fact that the arm was then on a different footing to the rest of the army, and was controlled by the dual government brought about by the existence of the Board of Ordnance.

In America the organisation of the artillery was at the commencement of the war equally unsatisfactory, batteries were at first almost regarded as battalion guns, there were not enough senior officers, and there was an entire absence of comprehensiveness in the fire direction of the batteries, because there was no independent central authority controlling the handling of the guns. It was as though Napoleon had never lived, Wagram and Friedland never been fought, and the Artillery of the Guard, "*qui decide la plupart des batailles*," had never existed. But the Americans were early brought to recognise the defects of such a system, and worked out their salvation in an original fashion as time went on, until methods had been evolved which guaranteed good results, and indeed differed little from those which have been proved correct by the experiences of war, both of our own and past eras. Before we enter more fully, however, into details, such as will help us to appreciate the teachings of the battles to which we shall presently

have to allude, we may profitably delay a moment to glance at the armament of the numerous artillery which took part in them.

The period of transition is clearly marked in the specification of the ordnance which was used.

According to the account of General Tidball, published in the July number of the "Journal of the Military Service Institution," U.S.A., at the commencement of the war all the regular companies of artillery of the Union armies, except eight, were acting as foot artillery, and were garrisoning the forts along the seaboard, or even acting as infantry on the Western frontier. Soon, however, in just the same fashion as was in vogue with ourselves in the days of the Crimea and the Mutiny, all these companies were, by a stroke of the pen, turned into Field Batteries, and a new regiment of Field Artillery was also raised in addition. The heavy artillery was manned, therefore, entirely by volunteers in the very manner by which in this country the detachments of our guns in the home forts would be formed in the event of a great crisis. In addition, however, to this regular Field Artillery, there was an immense proportion of volunteer batteries, some organised in regiments, some as independent batteries, while some were equipped as Horse Artillery for service with cavalry, as were also a proportionally large number of the regular batteries.

At the outbreak of the war, although rifled guns had not been introduced into the service, a large number had been already turned out on the Parrot system, and the army of the Federals was quickly supplied with them. These were soon followed by a 3-inch gun, which was known as the "ordnance" pattern, and it was established as the favourite in a short time. Meanwhile, however, the arsenals were ransacked to find weapons for the batteries fast coming into existence, and everything and anything in the shape of a gun was greedily snapped up and turned to account. Great confusion and difficulties in the supply of ammunition was the natural consequence; some batteries had a mixed armament, often extending to three kinds of pieces, and much vexation and a loss of efficiency supervened.

At the end of the first year, however, all the guns of the Army of the Potomac, which took part in all the first great battles which we shall have to notice, were either rifled pieces of uniform design, or 12-pr. "Napoleon" guns of the pattern which was the child of the Emperor of the French. In the armies of the West, however, it was not until towards the close of hostilities that anything like uniformity of armament prevailed.

The system of organisation of the artillery of the Union army similarly underwent a process of development as the war went on, and efficiency was purchased by experience often somewhat bitter.

Batteries were at first attached to brigades, and finally to divisions only. Army Corps were first formed in the Army of the Potomac in March, 1862, but not till some months afterwards in the other armies. Even then, however, batteries continued to be attached to divisions and, in the case of the Army of Cumberland, to brigades, until after the battle of Chickamanga. It was not until the spring of 1864 that the batteries of each corps were united into a brigade and made a separate command with a distinct staff and supply department.

The same system of organisation which was gradually evolved in the army of the Army of the Potomac was also by degrees developed in the others also, but since that army was the first organised, the largest, and the most symmetrical in its composition, it may be cited as an example of the others which were modelled on its lines.

Soon after the first battle of Bull Run, according to General Tidball, the artillery of this army consisted of only nine batteries comprising 39 guns, 650 men, and 400 horses. By the following March these numbers had swelled to 92 batteries, or 520 guns, 12,500 men, and 11,000 horses, fully equipped and ready for active service. Of this force 30 batteries were regulars and 62 volunteers. Nearly all the regular batteries were with this army, but owing to a difficulty in recruiting them, in many cases two had been knocked into one.

In the autumn of 1862 the army was divided into eleven divisions, to each of which four batteries were assigned. One of these was a regular battery to leaven the mass and serve as an example to the others, which were volunteers. The officers and men of the latter came fresh from civil employment, and had to learn everything, from the very alphabet of military training upwards.

We are assured that they proved apt scholars, and that in "an incredibly short time they were transformed into good serviceable batteries." Each battery was commanded by a Captain, and the senior Captain in each division was styled Chief of the Artillery for the division, and was supposed to exercise a supervision over the other batteries as well as his own, a duty, however, which was very vaguely carried out. There were no Field Officers and no staff in this mockery of an organisation, which subsequent campaigns soon proved weak and inefficient.

The batteries individually good were but small isolated units, and "were attached like excrescences to incongruous commands of infantry." There was no gradation of rank or command, nor was any combined action or uniformity of direction possible.

In addition to these batteries a so-called "Reserve" of artillery, consisting of 18 batteries, was formed, which was sub-divided into three brigades, one of which, consisting of four batteries, was for service with cavalry. When, after the Peninsular campaign, cavalry were formed into distinct bodies, these four batteries were assigned exclusively to them in the manner which obtains amongst European armies to-day.

The artillery "reserve" was a complete organisation in itself, and had a distinct commander, staff, and supply department. Its batteries being concentrated under the eye of an experienced chief were always ready to hand when needed, were more efficient than the others, and came to be regarded with pride and confidence throughout the army. They constituted in reality what we now term "corps" artillery, and became the trump card in the hands of the commanding General, as the arm had been in the days of Napoleon, and was again to be in the days of Moltke.

So far from being a reserve, they were almost always first in the fight, were constantly in demand, and, especially so in the case of the

Horse batteries, were responsible for a large share of the effective work done by the artillery during the first period of the war.

When later on experience showed the deficiencies of the earlier arrangement, and batteries were united in brigades under a senior officer, the reserve diminished in importance, and was gradually reduced until it became little more than a depôt where batteries hardly used in action might refit.

But prejudice dies hard; the Divisional Commanders viewed the new arrangements with little favour, and endeavoured to neutralise them as far as possible by obstruction. Although, however, all the advantages which might fairly have been expected did not appear, enough was done to show the value of the more liberal system, and when the war was ended it had undoubtedly demonstrated its worth.

The new powers as regards range with which rifling had endowed artillery could only be utilised and turned to account advantageously if guns were left free to select their own positions, apply their power in combination, and were no longer parcelled out at intervals along a line of infantry with whose movements they were expected to conform in the time-honoured manner which has come down, even to quite recent years, as a souvenir of muskets and flint-locks.

Artillery which possesses range can, and should, be used for the benefit of the whole, and not for any particular part. "Position," as General Tidball well observes, "is the chief factor in the use of artillery, and its importance increases in compound ratio with the range, accuracy, and power of the arm." A position good or inevitable for infantry may be a very poor one for guns, and it is, and was proved to be, folly to cripple one arm by insisting on its remaining attached to another in a manner alike unnatural and unnecessary.

The genius of Lee on the Confederate side early recognised the fatuity of such an arrangement, and, moreover, the weakness in point of numbers of that party authoritatively demanded such a wise application of them that no waste of force might take place. Before the first year of the war was at an end, therefore, Lee's batteries were united in battalions of from four to six in each. To the command of each battalion was assigned a Colonel or Lieut.-Colonel, while a Major was allotted to every two batteries. The "battalion," in fact, corresponded very much with the "Brigade-Division" of our own day.

The efficiency of the arm was so much increased by this system of organisation that the weak artillery of the Confederates was equal to coping with the much larger force of the arm on the other side, because its batteries acted in combination, whereas the others were dispersed.

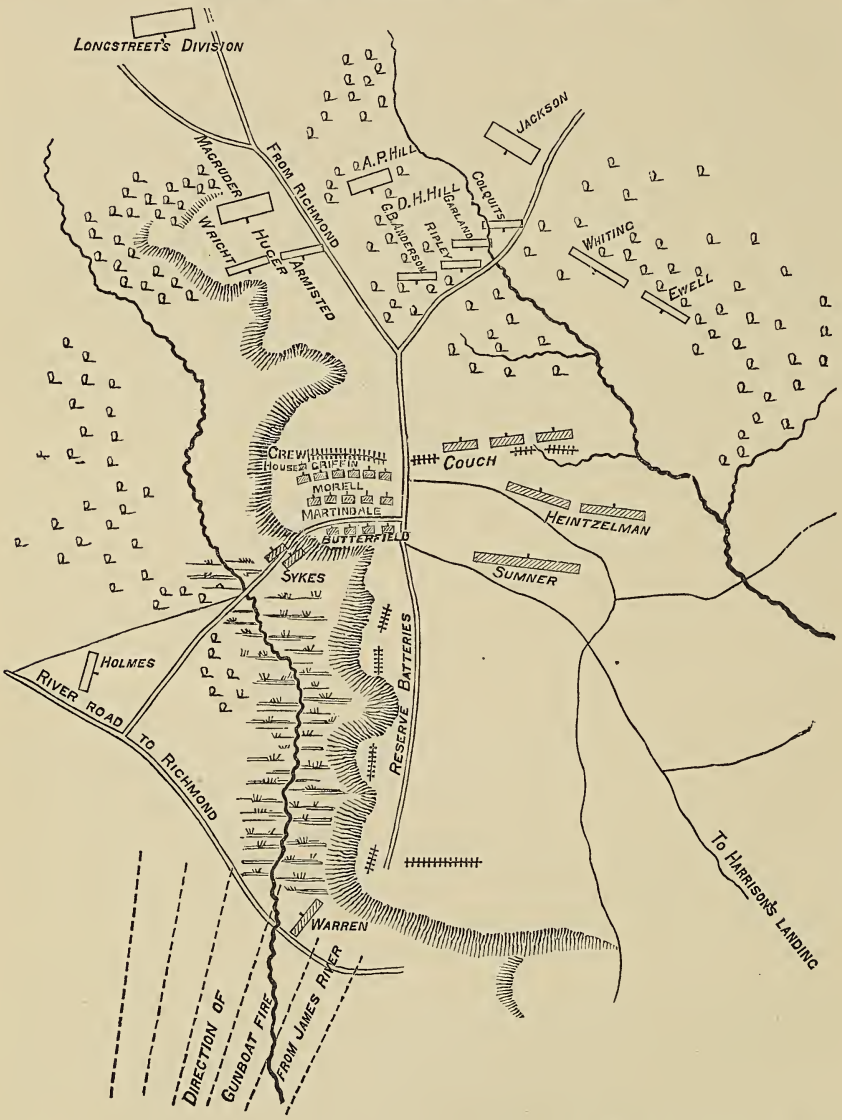
With these few words by way of preface we may now proceed to the consideration of a few of the principle occasions on which artillery during the lengthened struggle asserted its strength of effect.

In the earlier days of the war, in accordance with what has already been said, little evidence of a combined use of the arm is to be found, nevertheless the action of the battery, commanded by the subsequently celebrated artillery General, H. T. Hunt, at the first battle of Bull Run, on the 21st of July, 1861, deserves recognition at our hands.

In the main action the Federal army was defeated on that day, but

while its right was driven back, its left stood its ground so sturdily as to save the remainder from ruin. And this result was due to artillery,

BATTLE OF MALVERN HILL.—1st July, 1862.



and especially to the battery we have mentioned. In a memoir[1] of its commanding officer the story is thus told:—

"Seeing a large force of the enemy unexpectedly approaching the left of his battery, which was unsupported, he had the battery hurriedly brought round by hand, and opened on the charging foe with spherical,

[1] "Memoir of General H. T. Hunt," by David Fitzgerald.

case and canister, giving at the same time the order to load *without sponging the pieces,* for, as he naively remarks in his report of the battle, ' minutes were now of more value than arms.' We are glad to know that although this order was strictly carried out no casualties arose therefrom. His battery opened such a destructive fire on the advancing troops that they could not stand before it, but broke and fled in every direction, and in less than 15 minutes not a living man could be seen on the ground which so recently had swarmed with them." The Confederate official report characterises this fire as a "murderous shower."[1] It scattered the attacking column as if by enchantment, and affords an instance of the power of guns to hold their own unsupported by any other troops. When Hunt brought his battery out of action he found to his disgust a general retreat ordered. After vainly protesting against such a decision, he brought the battery off the field with no loss soever "*save that of a single bridle,*" and its steadiness subsequently, and the energetic exertions of Hunt and his officers, prevented a stampede and panic, such as had demoralised the right, from taking place.

The Confederate Commander-in-Chief, General J. E. Johnston, has borne testimony to what these guns accomplished when, with reference to their commanding officer, he wrote :—"In that action he commanded the artillery of the left with which he repulsed the attack on that wing unaided by other troops."

At the battle of Malvern Hill, one of the sanguinary battles fought in front of Richmond between the 26th of June and the 1st of July, we have an excellent example of what artillery fire can accomplish when guns are utilised in a mass. The importance of having a large body of guns in hand, we purposely omit to use the word "reserve" as a term distasteful to our modern notions, ready to be thrown into the scale whenever opportunity may occur, is likewise evidenced in the history of this action.

McClellan had selected Harrison's Landing on the James River as his base, and his camps were covered by the fire of the gun-boats upon it.

At the close of the several engagements on the 30th, in one of which, that known as the affair of Malvern Cliff, the attack of Holmes's division along the river road to Richmond was shattered by the Federal guns posted on the western crest of the hill, his whole army was drawn up in position on Malvern Hill, an eminence near the north bank of the river about sixty feet high, and having a level plateau on its top. His force was formed on an arc round this high ground, the flanks resting on the river. General Morell occupied the extreme left, with head-quarters at the Crew house; the brigade of Griffin in advance; Martindale's brigade in the Crew field, north of the Richmond Road; and Butterfield's in its rear, lying down south of the Richmond Road. General Griffin had command of all the artillery on the left. The position was one specially favourable for the use of guns, and General Hunt, whose deeds at the battle of Bull Run we have just given an account of, and to whose enlightened views the reforms in organisation gradually in-

[1] "The Outbreak of the Rebellion," by J. G. Nicolay.

troduced were due, was also an officer likely to turn all the advantages of ground to the fullest account. He was now in command of a large reserve of artillery, which he posted on the high ground at the western end of the plateau. His batteries were arranged behind and above the infantry, and the fire of 60 pieces, the majority of which were 20-prs. and 32-pr. howitzers, was concentrated so as to bring a converging fire to bear on any point in front, while, wherever the defence required special support, a battery quickly made its appearance. The difficulty of getting these guns across a swamp, which lay at the foot of the hill, and up its sides had been immense, but had been overcome by the toil of a strong force of gunners, many of whom volunteered their services from other batteries.

General Lee, although his men were considerably fatigued after all the fighting they had recently been through, determined to attack the Federals. The ground at the foot of the hill, save in its immediate vicinity, was thickly wooded, and communication was difficult, circumstances which prevented the Confederates from bringing up a sufficient number of guns to oppose successfully the powerful batteries which their opponents had placed in position.[1]

At about 1 o'clock p.m., on the 1st July, Whiting's and D. H. Hill's advance appeared in the plain beyond the belt of woods at the foot of the hill, and were immediately fired on by the Federal artillery. Some broken ground in their front might afford them cover, but ere they could reach it they must pass across an open field and ford a stream under the terrible fire of the guns above, and they lost heavily ere they gained the shelter. Having reached it they were halted for a time in comparative security while General Hill examined the position of his opponents. Meanwhile the artillery which was to support the attack began to make its appearance, but as they came under the concentrated fire of the batteries on the hill they were so roughly handled that they had to retire out of action almost as fast as they reached their ground. All this time small bodies of the Confederate infantry made repeated efforts to leave the trees and get within musketry range of the terrible guns. But as each party gathered way four batteries poured a converging fire on it, and invariably it melted away and disappeared.

General Lee had arranged that a combined effort was to be made by all portions of his force as soon as they were all in their proper positions for the assault. Hill's division, therefore, tarried under cover for the sign to move.

Not so, however, Huger and Magruder, who were on his right.

As soon as the latter could get a battery into position he opened fire, and impatiently sent a regiment to charge up the hill. The battery was speedily crushed by the storm of shells its appearance had provoked, and unsupported by artillery the regiment rushing forward was struck full in front as by the blast of a tempest, and rolled headlong back. Three times were the gallant infantry thus sent forward to face the storm, and three times did they meet with a like fate. Magruder claimed that in his final effort he got perilously near to the guns, but his story is not to be accepted without reserve, and it is asserted by his

1 "The Peninsula." McClellan's Campaign of 1862, by Alexander S. Webb.

opponents that his most determined rush never reached so near the batteries as to seriously threaten their safety. Some, it is true, in exposed positions limbered up and withdrew to more favourably situated spots in rear, but there they again came into action and opened fire on him.

The cry for artillery, which never fails to rise when infantry find they can no longer make headway, now went up from the Confederates. The power of artillery had paralysed the forward movement, and the attack cowered helplessly whereever cover might screen it from the shells. Armistead called to Longstreet for more batteries, but called in vain. Magruder wanted 30 pieces of rifled artillery, but it did not come. D. H. Hill sent to tell Jackson how the fire of isolated batteries was worse than useless, how guns thus thrown into action were exposed to destruction in detail, and pleaded, nay, even insisted, that 100 guns should be concentrated on the Federal line.

One is reminded of Ney sending to Napoleon for infantry in the evening at Waterloo, and Napoleon's reply, "*Voulez-vous que J' en fasse?*" Here, too, Jackson's only response was an order to advance at the signal as had been arranged.

At length, about 5.30, Hill fancied he heard the shouting which was to tell him to move forward. "Garland in fact attacked the hill with impetuous courage, but his strength was soon spent and he sent for reinforcements."

"The 6th Georgia, and the brigade of General Toombs, which was under partial shelter in the rear, was sent to his assistance, and General Hill in person accompanied the column. They showed a bold front as they approached the crest, but discipline was no avail to hold them there, much less to make them advance further. They soon retreated in disorder."[1] Gordon's brigade made some progress at first, but soon he fled, and Ripley's, Colquitt's, and Anderson's brigades were wildly streaming back also. Demoralised and panic stricken they sought the woods for safety.

From other divisions, too, reinforcements were sent to Hill, but none would tempt their fate for long before those merciless batteries. They suffered heavy losses but accomplished nothing, and were soon huddled together a disorganised mass of men whereever shelter might be found. Hill himself has lately told the story in the *Century Magazine*, and this is what he says:—"Our loss was double that of the Federals at Malvern Hill. Not only did the fourteen brigades which were engaged suffer, but the inactive troops, and those brought up to act as reserves too late to be of use, met many casualties from the fearful artillery fire which reached all parts of the woods for miles around. Hence more than half the casualties were from the Federal field pieces, an unprecedented thing in warfare."

This evidence of an actor in the drama, and an eye-witness of what occurred, is eloquent in favour of the claim artillery puts forward to a power of accomplishing something more than that merely moral effect which is all that many seem willing to credit it with.

Nor does General Hill speak alone. All the Confederate Generals

[1] "The Peninsula," by A. S. Webb.

ascribe the failure of their effort to reach the hill to the preponderating effect of the artillery fire on the side of their opponents, and to the manner in which their infantry was left to face the batteries alone.

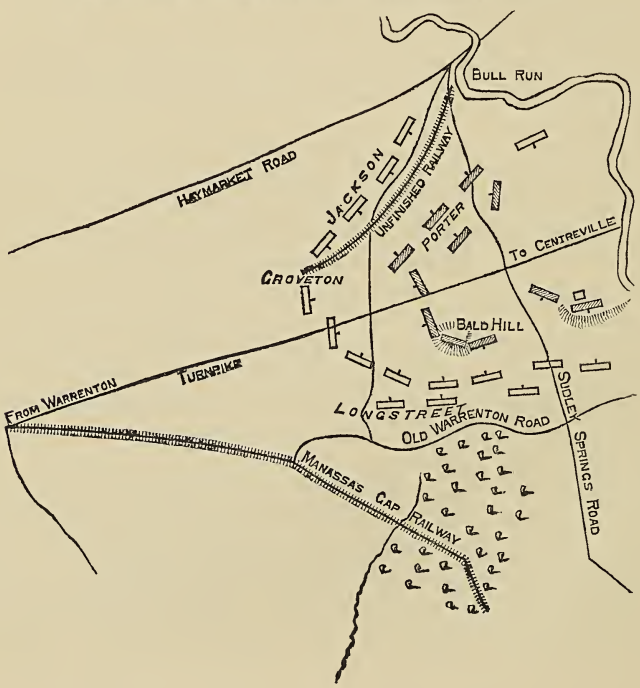
One of the leading Generals on the Confederate side is quoted by Lieutenant Birkhimer as saying, "The result was exclusively due to the Federal artillery fire, which seemed as destructive as could have been that of 20,000 muskets, and I doubt if that number of muskets could have held the position and driven our forces back."

And in his report of the seven days' battles, of which that of Malvern Hill was one, the Union commander (McClellan) remarked—"It is not my purpose now to make mention of distinguished services. . . . . I will simply call attention to the invaluable services rendered by the artillery, and say that its performances have fully justified my anticipations, and prove it to be our policy to cherish and increase that arm."

Magruder's splendid charge is worthy of our admiration as a determined effort of infantry to reach guns in position. All that bravery could accomplish was done by them, but when they emerged from the cover of the woods, in which the line of their advance was formed, they were always met by the same storm of missiles, and, often as they renewed their efforts, they never could progress beyond the limit which the guns set to their courage. Malvern Hill may therefore fitly illustrate an achievement of which artillery has every reason to be proud, and may justly figure with Friedland, Wagram, and Eylau of the preceding era.

But a month later guns were again to have an opportunity of displaying powers equal to something more than moral effect. On the 30th

BATTLE OF MANASSAS.—30th August, 1862.



of August, 1862, was fought the second battle of Bull Run, or Manassas, as the Confederates call it. In the first battle at that place we have seen how a year previously the Federal artillery distinguished itself on their left by the firm front with which it faced its foes, and saved the army from total ruin. In this second battle we shall find the Federals experiencing the powers of their adversaries, and we shall notice an excellent example of the offensive force of the arm, of artillery brought up in place of reinforcements of other troops, and striking a blow which, if not decisive of the fate of the battle, had at least a very notable influence on one phase of it.

The Federal General, Pope, having fought a successful action on the previous day imagined that he had a beaten and retreating enemy in front of him, and, indeed, his only anxiety was that he might slip away. In reality the Confederates were so little demoralised that they were intending to attack Pope, and were only apprehensive that he might elude them.

General Pope hurried Porter's corps forward to the north of the turnpike, and was so confident that Longstreet had retreated that he ignored him altogether, while he directed his attention almost entirely on Jackson, who stood opposed to him on the railway embankment.

Longstreet, who was watching the movements on the Federals left flank, says that their whole army seemed to surge up against Jackson as if to crush him with an overwhelming mass.

About four o'clock Porter pushed Morell's division out to the front, and the Confederates as their foes came on in superior numbers, were driven out of the woods in front of their position and fell back on the old railway embankment. The attack was made with the greatest resolution. Jackson's veterans resisted with dogged determination and pluck, but were steadily forced backward. The Federals gradually pressed right home to the embankment. Longstreet, who was an interested spectator of it all, writes thus—"It was a grand display of a well organised attack thoroughly concentrated and operating cleverly."

The enemy's rush is so strong that Jackson's stout heart fails him for a time. He fears he cannot resist it much longer, and sends to beg Lee to send him reinforcements, and Lee orders Longstreet to go to his assistance. But Longstreet, watching the fight from his vantage point, saw that he could not usefully go to Jackson, and, moreover, he thought he could aid him better in another way. This is what he says: "To retire from my advanced position in front of the Federals and get to Jackson would have taken an hour and-a-half. I had discovered a prominent position that commanded a view of the great struggle, and realising the opportunity I quickly ordered out three batteries, making twelve guns. Lieut. Wm. H. Chapman's Dixie battery of four guns was the first to report, and was placed in position to rake the Federal ranks that seemed determined to break through Jackson's lines. In a moment a heavy fire of shot and shell was being poured into the thick columns of the enemy, and in ten minutes their stubborn masses began to waver, and give back. For a moment there was chaos, then order returned and they reformed, apparently to renew the attack. Meanwhile my other eight pieces reported to me, and from

the crest of the little hill the fire of twelve guns cut them down. As the cannon thundered the ranks broke, only to be formed again with dogged determination. A third time the batteries tore the Federals to pieces, and as they fell back under this terrible fire I sprung everything to the charge. My troops leaped forward with exultant yells, and all along the line we pushed forward. Farther and still farther back we pressed them, until at ten o'clock at night we had the field. Pope was across Bull Run, and the victorious Confederates lay down on the battle-field to sleep, while all around were strewn thousands—friend and foe, sleeping the last sleep together."[1]

It would be difficult to add anything to this eloquent tribute to what may be done with guns, but we cannot lose the opportunity of recording our admiration for the soldierlike instinct that conceived and directed the blow, and obeyed Lee's order in the spirit and not in the letter in which it was delivered. Mr. J. C. Ropes, in his excellent account of this battle,[2] also adds the following words of General Longstreet: "as it was evident that the attack against General Jackson could not be continued for ten minutes under the fire of these batteries, I made no movement with my troops. Before the second battery could be placed in position the enemy began to retire, and in less than ten minutes the ranks were broken and that portion of the army put to flight."

A year later, when Lee and Meade met to contest the possession of the Northern States on the ridges of Gettysburg, artillery again played a great part in three days of the most stubborn fighting of perhaps all the war. The Army of the Potomac under General Meade numbered 82,000 men and 300 guns, to which Lee was able to oppose 73,500 men and 190 guns. Stuart with the latter lead 11,100 sabres and 16 guns, and Pleasanton with the former had about the same number of cavalry, and 27 guns.

On the 1st of July, 1863, the Confederate army, advancing on Gettysburg from the North and West, struck the advanced posts of the Federals to the west of the town about 9 o'clock. The Federals being at first in inferior numbers were forced gradually back on the Seminary Ridge, here General Doubleday rallied his troops, and his artillery did excellent service in checking the enemy's advance.[3] "The first long line that came on from the west was swept away by our artillery, which fired with very destructive effect, taking the rebel line '*en echarpe*.'" Although the Confederates came on in great numbers by the aid of this artillery, whose fire throughout was most effective, the Federals were able to beat back their foes, and almost detroyed the first line of the Scales's brigade. Scales, who was wounded himself, says in his account that "the fire was most severe," and that "every field officer but one was killed or wounded." Eventually the shattered 1st Corps was obliged to fall back, which it did under the covering fire of its batteries, who remained in position to the latest possible moment, and were compelled

[1] "Battles and Leaders of the Civil War," Vol. II.

[2] "The Army under Pope," by J. C. Ropes.

[3] "Chancellorsville and Gettysburg," by A. Doubleday, Major-General, Commanding 1st Corps at Gettysburg.

to abandon one gun to the enemy. In the evening the Federal line had fallen back to the Cemetery Hill and heights east of Gettysburg, while on the opposite slopes the Confederate army was gathered ready to renew the fight on the following morning.

Next day Lee determined to assail both flanks of the Federals, and also to demonstrate against them at the centre to prevent either wing from being reinforced.

The attacks on the extremities were intended to have fallen simultaneously, but attempts to direct columns several miles apart so as to converge on one point are extremely difficult to carry out successfully, and in this case Lee's arrangements miscarried, the action on the Confederate right being over ere that on their left had commenced. Longstreet on the Confederate right commenced the battle by assaulting the Federal line near the Peach Orchard where their 3rd Corps was posted.

BATTLE OF GETTYSBURG (SECOND DAY).—2nd July, 1863.

Its formation was extremely faulty,[1] for, while part held the line of the road to Gettysburg, the remainder was doubled back along the road from Peach Orchard, easterly to the ridge, almost at right angles with it. It is round this angle that the interest to artillerymen of the second day's fighting is centred, for truly every episode of an artillery combat is there to be found, and while the power of their arm in concentration is well illustrated, the splendid devotion with which its destructive force was met and struggled against on the part of the

[1] It should be noted, however, that General Hunt has contended that this was the best way to occupy the ground.

Federal gunners no less fixes our attention, and further, the skilful tactics by which their strength was husbanded for the decisive moment is specially to be praised.

The Federal line, as we have said, was miserably badly placed here, and when one of their batteries opened the fight late in the afternoon, a long line of eleven batteries on the height opposite replied with an ominous roar that showed that the disadvantage of their situation had not been overlooked. Three of their batteries at first attempted to uphold the contest alone, but four from the reserve had soon to be summoned to their assistance. The infantry were able to gain some shelter behind walls from the iron hail which is described as showering down upon them, and the configuration of the ground greatly favoured them, but the guns had to withstand the tempest exposed upon the crest. It soon, however, became apparent that the contest was a hopeless one, and then one battery was deliberately sacrificed to enable the others to take up a new line in rear. The Federal batteries which lined the cross road which runs from Peach Road easterly were the worst placed, but were manned so gallantly that in spite of fearful losses they succeeded in doing most effective service. At length they were captured, but only temporarily so, for an infantry battalion made a gallant charge to their rescue, and eventually they were dragged back from their positions by hand. It was then that Bigelow was ordered by Major McGilvery, who commanded the four batteries, to sacrifice his guns in order that the others might gain a new position, and accordingly he fought them with fixed prolongs till the enemy were within six feet, but got them away in the end with a loss of 3 officers and 28 men, while 65 out of 88 horses were killed.[1] A battery next to him had a very similar experience, and testimony was borne by their opponents to the excellent manner in which these guns were served when they stated that thirty men, out of a company of thirty-seven, were killed and wounded by one shell.

Twenty-five guns were got together by adding the remnants of various broken batteries to some which remained intact, and this solid mass, unsupported by any infantry, held this part of the line for the remainder of the day. While, therefore, the fire of Longstreet's guns gives us another example of their correct handling in masses, we are supplied with a no less excellent illustration on the other side of a specially noticeable example of a service artillery is not infrequently called upon to render when it has to sacrifice itself for the safety of the general line.

Note.—On the same day an incident at the other extremity of the Federal position occurred which we may perhaps be allowed to notice, although it can scarcely figure as a legitimate artillery achievement.

During the attack on the other flank of the Federal position, which took place a little later than the one which has just been described, two of the defender's batteries were temporarily captured.

General Hunt gives the following vivid account[2] of how their gunners re-took them:

"The cannoneers of the two batteries, so summarily ousted, rallied and recovered their guns by a vigorous attack—with pistols by those that had them, by others with handspikes, rammers, stones, and even rail fences—the 'Dutchmen' showing that they were in no way inferior to their 'Yankee' comrades, who had been taunting them ever since Chancellorsville. After an hour's desperate fighting the enemy was driven out with heavy loss, Avery (Brigadier-General) being among the killed."

[1] Doubleday's "Chancellorsville and Gettysburg."

[2] "Battles and Leaders of the Civil War." Vol. III.

The account[1] of this day's fighting given by Brigadier-General Porter Alexander, who commanded the artillery of Longstreet's corps, and concentrated his batteries as has been described, is full of interest. He says, speaking of the commencement of the attack (about 4 o'clock), "The Federal artillery was ready for us in their usual full force and good practice, the ground of Cahell's[2] position gave little protection, and he suffered rapidly in both men and horses. To help him I ran up Huger with 18 guns of my own 26 to within 500 yards of the Peach Orchard and opened on it. This made 54 guns in action, and I hoped they would crush this part of the enemy's line in a very short time, but the fight was longer and hotter than I expected. So accurate was the enemy's fire that two of my guns were fairly dismounted, and I had to ask General Barkdale, whose brigade was lying down close behind in the wood, for help to handle the heavy 24-pr. howitzers of Moody's battery. He gave me leave to call for volunteers, and soon we had eight good fellows, of whom alas! we buried two that night, and sent to the hospital three others mortally or severely wounded. At last I sent for my other two batteries, but before they arrived McLawes's division charged past our guns, and the enemy deserted their line in confusion. Then I believed that Providence[3] was indeed "taking the proper view," and that the war was very nearly over. Every battery was limbered up to the front, and the two batteries from the rear coming up, all six charged in line across the plain and went into action again at the position the enemy had deserted. I can recall no more splendid sight on a small scale—and certainly no more inspiriting moment during the war—than that of the charge of these six batteries. An artillerist's heaven is to follow the routed enemy, after a tough resistance, and throw shells and canister into his disorganised and fleeing masses. There is no excitement on earth like it. . . . . Everything was in a rush. The ground was generally good, and pieces and caissons went at a gallop, some cannoneers mounted, and some running at the side—not in a regular line, but a general race and scramble to get there first."

The battle, far less the war, was by no means over, however, and as night closed in the soldiers on both sides realised that another struggle would have to be entered on in the morning.

Lee had now attacked both flanks of the Army of the Potomac without success, and prepared to make a final great effort upon the centre. A great mass of guns was to concentrate its fire on the enemy's line from Cemetery Hill towards Round Top, and the assault was to be delivered when the guns had demoralised the defence. To Pickett's division of Longstreet's corps, the flower of the army of Virginia, was entrusted the honour of making the great final charge, and Alexander brought together 75 guns to form one battery opposite Cemetery Hill, while a little to their left 63 guns of Hill's corps were posted. The Confederates brought about 150 guns to bear on the point selected for

[1] "Battles and Sieges of the Civil War." Vol. III.

[2] Commanding a "battalion" of 18 guns.

[3] Referring to a prayer one of the Confederate Army Chaplains was in the habit of making use of, that "Providence would come down and take a proper view of the situation."

attack, but their opponents, hampered by want of room, could only place about 80 in position on the opposite heights against them. In the morning some desultory fighting took place, but about noon all was "silent as a churchyard." The Federals confident in the strength of their position sat still and waited. The Confederates were grimly busy with their preparations.

At 1 o'clock two signal guns were fired and 150 pieces at once opened a tremendous cannonade on the Federals. On their side the reply was prompt, and, although outnumbered, their guns did great execution. Brigadier-General Alexander says, "the enemy's position seemed to have broken out with guns everywhere, and from Round Top to Cemetery Hill was blazing like a volcano." He says that during this day's fighting his own battalion (consisting of 26 guns) lost 144 men and 116 horses, "nearly all by artillery fire," while he congratulates himself on having caused a loss to one of his opponent's batteries of "27 out of 36 horses in ten minutes."

General Doubleday, who witnessed the combat from the other side, speaks of the severity of the Federal losses, and says that 11 of their caissons were blown up at this time.[1] "When the smoke went up from these explosions rebel yells of exultation could be heard along a line of several miles."

General Hunt, who commanded the artillery on the Federal side, wishing to preserve as many guns as possible intact, and with ample ammunition to withstand the inevitable assault, after two hours withdrew 18 guns from the Cemetery Hill and ordered the Federal artillery to cease firing.

This manœuvre quite deceived General Alexander. He imagined that he had silenced the enemy's artillery, and sent back to tell Pickett and Longstreet, and the assault was launched with much misgiving on the part of the latter, who felt the enterprise was an extremely hazardous one.

Meanwhile General Hunt replenished his limber-boxes, and substituted batteries from his reserve for those that had been much knocked about.

Pickett's division, after a pause for preparation, came on magnificently. They must traverse a mile and-a-half from the woods where they had been posted ere they could gain their goal.

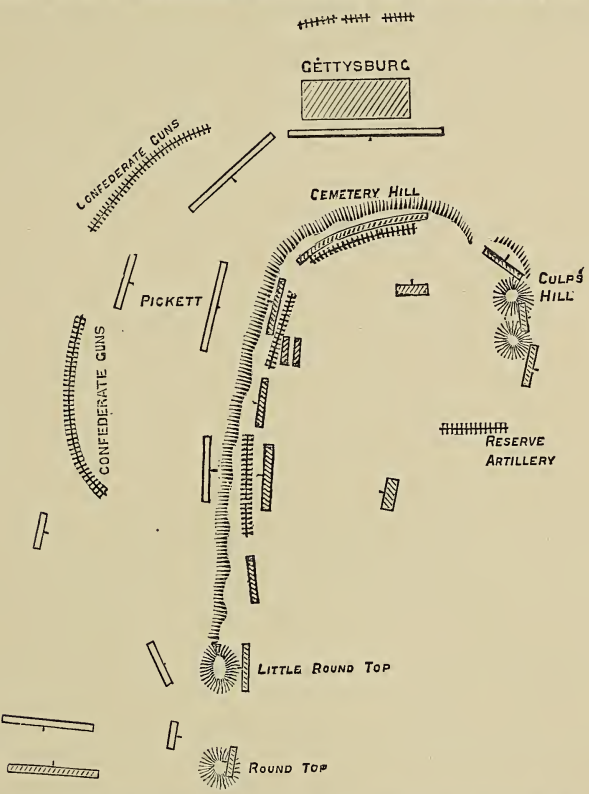
Meanwhile the ammunition of the Confederate guns had run low, and only about 18 had enough to push forward with this advance.

But no sooner had they debouched on the plain than the 18 guns were back on Cemetery Hill, and artillery fire burst forth all along the Federal line. Doubleday says "they suffered severely from our artillery, which opened on them with solid shot as soon as they came in sight; when half way across the plain they were vigorously shelled; double canisters were reserved for their nearer approach." The guns of their own side were silent as they passed between them, then they opened over their heads when they had got a couple of hundred yards away. The Federal artillery let this artillery alone, and only fired at the infantry. Yet Pickett's division swept bravely on and eventually

[1] "Chancellorsville and Gettysburg."

disappeared in the smoke of the batteries before them. They were watched with breathless excitement by their comrades of the artillery behind them. The fate of the campaign hung on their failure or success. For five minutes the struggle in the smoke continued, then the event had culminated, and they "seemed to melt away, and only disorganised stragglers pursued by a moderate fire were coming back." Lee watched it all among Alexander's guns, and perhaps realised, as he saw such an army as he could never hope to lead again broken, that his cause was lost.

BATTLE OF GETTYSBURG (THIRD DAY).—3rd July, 1863.



The Confederate batteries had produced destructive effect amongst the Federal guns, but the infantry were able to gain cover behind walls and in the broken ground and suffered less.

Two batteries, where the Confederate fire had focussed, were practically destroyed. Doubleday's narrative states that Cushing, who was in command of one of these, being mortally wounded in both thighs, ran his last serviceable gun down to the fence as Pickett's advance came very close, and shouted to his General, "Webb, I will give them one more shot!" "At the moment of the last discharge he called out 'good-bye' and fell down dead."

General Hunt, who so ably commanded the Federal artillery, has written an account of this day's fighting, which is extremely interest-

ing from an artillery point of view. He describes how he noted the great line, two miles long, of Confederate batteries getting into position in the morning, foresaw their purpose, and instructed his Battery Commanders to reserve their ammunition, as to the sufficiency of which he felt some anxiety, for the infantry assault. Then he goes on to say, "the Confederate approach was magnificent, and excited our admiration, but the story of the charge is so well known that I need not dwell on it further than concerns my own command. The steady fire from McGilvery and Rittenhouse on their right caused Pickett's men to 'drift' in the opposite direction, so that the weight of the assault fell on Hazard's batteries. I had counted on an artillery cross fire that would stop it before it reached our lines, but except a few shots here and there Hazard's batteries were silent until the enemy came within canister range. They had unfortunately exhausted their long range projectiles during the cannonade, under the orders of their Corps Commander, and it was too late to replace them. Had my instructions been followed here, as they were by McGilvery, I do not believe that Pickett's division would have reached our line. We lost not only one-third of the fire of our guns, but the resulting cross fire which would have doubled its value. The prime fault was in the obscurity of our Army regulations as to the artillery, and the absence of all regulations as to the proper relations of the different arms of the service to one another. . . . . Soon after Pickett's repulse, Wilcox's, Wright's, and Perry's brigades (Confederate) were moved forward, but under the fire of the fresh batteries in Gibbon's front, of McGilvery's and Rittenhouse's guns, and the advance of two regiments of Stannard's Vermont brigade, they soon fell back. The losses in the batteries of the 2nd Corps were very heavy. Of the five Battery Commanders and their successors on the field, Rorty, Cushing, and Woodruff were killed, and Milne was mortally, and Sheldon severely wounded at their guns. So great was the destruction of men and horses that Cushing's and Woodruff's (United States), and Brown's and Arnold's (Rhode Island) batteries were consolidated to form two serviceable ones."[1]

With this episode we may close our account of what artillery did in the American War. We have not by any means completely exhausted that rich repository of brilliant deeds, and many bright examples on a small scale are reluctantly omitted. Enough, however, has perhaps been said to show that the arm can scarcely be with justice reproached for lack of enterprise during the great struggle. Some even may think with us that, as regards the conduct of officers and men in action, efficient service of guns, and judicious handling on the part of its more prominent leaders, artillery showed itself in no degree unworthy of the great traditions handed down to it from the previous era, and may point with satisfaction to what it accomplished.

[1] "The Third Day of Gettysburg," by Major-General H. T. Hunt, from "Battles and Sieges of the Civil War."

(To be Continued).

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FIRE DISCIPLINE; ITS NECESSITY IN A BATTERY OF HORSE OR FIELD ARTILLERY, AND THE BEST MEANS OF SECURING IT.

BY

CAPTAIN F. J. A. TRENCH, R.H.A.

"UNHASTING YET UNRESTING WORK."

COMMENDED ESSAY, 1892.

Introductory.

Upon the very threshold of the subject of Fire Discipline the unwary intruder is greeted, not, indeed, by *cead mille failthe*, but by two serious difficulties. What is the exact meaning of the term, and why is it that what it denotes should be now-a-days so much to be desired? the expression itself is of but recent naturalisation (or evolution), and certainly our old wars had none of it.

The most satisfactory solution of these problems would seem to be found in the study of the development of the arm. The history of artillery divides itself into two very strongly marked periods: the five-hundred years which separate Crecy from the Crimea, and the few decades which have elapsed since then. At first sight this division would seem to be fanciful, but a closer examination fully justifies it. If we take any battle of the big wars at the beginning of the century we find little change, either in the *matériel* or the handling, from what obtained when artillery was first introduced. The commander brought his battery into action within a few furlongs of the enemy, and then, handing his guns over to the "numbers one," let the fire wander at its own sweet will. And, indeed, it could scarcely stray far: there was no mistaking the position of the enemy, and the error of a hundred yards in the estimation of the range was nearly impossible. The *matériel* was so simple that it hardly afforded any scope for instruction, the most important duty of the gunner seeming to have been—to

judge from the drill-book of the period—to "spunge out his piece smartilie and thereby afford much contentment to the bystander."

With the Crimea, however, came a great change in artillery owing to the introduction of rifling. Elongated projectiles, flatter trajectories, fairly reliable time fuzes, telescopic sights—all children of the rifled gun—have added enormously to its power and range, but the increase of range and complication of *matériel* have also greatly multiplied the possibilities of ineffective fire. The necessity has, therefore, arisen for a more systematic, concerted guiding of the battery, which, up till quite recently, had always, on coming into action, resolved itself into six comparatively independent units. The idea, however, that each gun was the private show of its "number one" has died hard; and, indeed, this is scarce to be wondered at, for until last year the error received very practical—and pecuniary—support from the system in vogue of individual competitive practice.

This has now, however, been relegated to the limbo of lost things, and with its disappearance has dawned the third period into which the history of Field Artillery divides itself: the era of Fire Discipline. A striking contrast is noticeable between the two re-organisations: our earlier improvement was one in *matériel*, our recent development is entirely in the training of the *personnel*, in the organisation of the battery as *one weapon wielded by one man*.

The secret of the great change which is now taking place lies in the recognition of the truth that the aim and goal and great event to which the peace preparation of artillery moves is the *mauvais quart d'heure* which begins when opposing batteries open fire—for the duel that then commences is one to the death, decimation is a bagatelle, and there is only one end: the complete and utter annihilation of the side which goes to the wall. This fact once grasped, the principles which are henceforth to be the basis of artillery peace training stand out very distinctly. Every hour available for gunnery instruction must be utilised, every nerve strained, every round of ammunition devoted to the one aim of making the battery a perfect piece of mechanism in which every portion shall be fully fitted to the part it has to play, in which none shall be idle or superfluous, in which all, from the highest to the lowest, have their sphere of usefulness and importance. Constant practice—in which the casualties and difficulties of the fight have been foreseen and prepared for—must remove all possibility of friction and produce such harmony and thorough mutual understanding that the battery will, under fire and in moments of intense mental and physical strain, not only obey every command, but almost instinctively anticipate every wish of its leader.

Nature of Fire Discipline.

Fire Discipline, then, is that perfection of training which gives to the commander that meed of control, that *grip* of his battery in action which enables him to direct its fire with the same confidence, ease, and certainty as a capable rider guides a well-broken horse. This, however, is no easy matter to obtain. Discipline of any kind is more than a desire to please—it is an instinctive, ingrained, unquestioning habit

of obedience so deeply rooted as to overcome even strong natural impulses and desires, and this habit can only be formed by constant careful practice—no less in the fire of a battery than in the conduct of an individual.

The necessity, too, that our Fire Discipline should be of the very highest quality hardly needs proof. War is a game in which comparisons are continually made; success depends less upon intrinsic merit than on comparative superiority. When the progress of artillery consisted mainly in improvement of *matériel* the question was one which concerned the regimental officer more remotely. The nation which had the best guns had the best artillery arm as a rule, and the introduction of a new weapon necessitated but few changes in handling, witness the intermixture of smooth-bores and rifled guns in the Prussian armies in 1866. Now, however, guns are practically the same all the world over, and the superiority of one artillery over another, when once on the battle-field, consists mainly in the pitch of perfection reached in the training and Fire Discipline of its *personnel.*

Difficulties.

Unfortunately this modern necessity for a higher standard of efficiency finds us already struggling with difficulties which it takes no small energy and perseverance to cope with. The introduction of short service and the high prices that obtain in the labour market have reduced the age of the recruit and diminished the period for which he serves, while to make matters worse, that *fin de siècle* daughter of the horse leech, the Indian draft, is so exacting, that home batteries outside the 1st Army Corps can barely count (for the training of their young gunners) upon the three years which are considered necessary among nations which have universal conscription. Thus the increase in the tale of bricks we have to furnish follows close upon the reduction of our allowance of straw.

The Remedy.

These then are our difficulties; but difficulties were made to be overcome—recognising them is half the battle: the only question which remains is what is the best way. In the mind of the present writer there is but one answer to the problem. It is *unhasting yet unresting work*, patient, *systematic*, careful, thorough instruction.

It is, perhaps, in the system—or rather in the lack of it—that our present *modus operandi* leaves so much to be desired. There is so much to teach, so little time in which to impart the instruction, that it is absolutely imperative that not a minute shall be wasted, not an opportunity neglected. The instruction must be so arranged that each one is thoroughly taught and practised in that which it is necessary for him to know, and that only; nothing must be omitted, nothing unnecessarily repeated; the grounding must be thorough, the stages progressive, and through all must be remembered the all-important fact that preparation for war is our sole and only *raison d'être.* It is to be feared that such a system is far from being our general practice;

the recruit is given a scanty elementary course, and his subsequent training is by the easier method of fault-finding. Many batteries live from hand to mouth, the morrow takes care of itself and technical training is subordinated to the more pressing requirements of daily administration and the rendering of returns.

For this let us substitute some definite method, applying the chain of responsibility to instruction, as well as to interior economy, and dividing our time into progressive periods, each with a goal to be reached, and in its turn left behind for some fresh one, and surely we may look for an outcome far in excess of what we at present obtain. It is in this belief that the following suggestions are made as some indication of a direction in which our Royal Regiment has still much to attempt and much to achieve.

And here, perhaps, a slight digression is necessary in order to disclaim, *in toto*, any idea of depreciating the value of good horse-mastership, and its overwhelming importance. Guns which are making fair shooting on the battle-field are obviously of more value than ones which have not been able to reach it, and efficiency in front of the splinter-bar is quite as necessary as behind it. This question is, however, so obviously outside the limits of the subject that it is only alluded to this once in order to avoid any possibility of misapprehension.

Conditions of the Problem.

Taking, then, the conditions of service at home into consideration, we find that though fresh men come and go at all periods of the year, yet the instruction of the battery is largely influenced by two main epochs: the winter trooping season and the summer drills or manœuvres. The rapidity with which the various phases of field days of the three arms follow each other renders them very unsuitable for the practice of artillery *technique*, and thus we are under the obligation of finishing it before they begin. It may almost be said—tho' with bated breath—that their tendency is rather to undo many of the good results and strict discipline so laboriously attained on the drill-ground (though obviously of great use to the higher ranks), and we must endeavour to obtain, before they begin, all the fire discipline which we now look upon as so needful.

The beginning of the summer being then our time limit, whether it be on account of summer drills or practice camp, it becomes necessary to commence our task well before the end of the furlough season, and indeed this is in many ways most advantageous, as theoretical instruction in gunnery is obviously the precursor of all teaching as regards artillery fire.

For many reasons the winter is the most suitable period for gunnery instruction. The weather often necessitates the use of gun-shed and lecture-room, the paucity in numbers of men available makes individual instruction and attention easier, and the wide range of the subjects makes it desirable to spread them over a more or less extended period instead of crowding them into a fortnight. The regulation sixty-hours' course may thus well come in the leave and furlough

season, and by making it last through three months there is a probability that the lectures will be more thoroughly prepared and more fully comprehended. As a general rule it is easy to arrange the gunners' furloughs so that they take place during the leave of their sectional officers. A journal of the subjects and attendances should be kept, and a short supplementary course at the end, under the captain, may well make up for what has been missed owing to employment, sickness or other cause, for all three sections. Battery gun drill—as distinguished from single standing gun drill—should obviously be rigidly excluded from this part of the course as belonging to a higher grade of instruction.

At the commencement of the drill season each battery should be struck off duty for a week for a thorough course of marching, sword and carbine drill, under the Section Commanders, and the examinations should take place for laying and gunnery prizes and classification of gunners.

Chain of Responsibility.

Great stress is laid on the principle that up to this time the Major has exercised merely a general supervision over the instruction of the sections which, as regards matter and method, have been entirely in the hands of the subalterns, to whom should accrue credit or blame according as good results or bad are attained. Naturally the amount of supervision and interference on the part of the Battery Commander would depend entirely upon the reliability and experience of the Section Officer, and might vary from *nil* to absolute control. It must be remembered, however, that officers have to be educated as well as their subordinates—indeed this is one of the great duties of commanders—and this can only be done by the early exercise of initiative and responsibility under the supervision and guidance of those who are more experienced. This is a principle admitted by all in theory, but more honoured in the breach than in the observance. "If you want a thing done" it is undoubtedly easier to do it yourself than to train another; but incalculably valuable opportunities of education in its highest sense are thereby thrown away.

1st Annual Inspection.

Towards the end of March or beginning of April should take place the annual *dismounted* inspection by the Lieut.-Colonel, in gunnery, standing gun drill (single), carbine drill, sword and marching drill. Should the general result be satisfactory the battery should be considered to have graduated in these subjects for the year, a monthly parade of each nature being merely necessary to furbish them up. Special men should, if necessary, be temporarily relegated to 2nd class or recruit squads, and any general short coming on any particular point should be remedied by special attention for a few days more.

The time has now come for the battery to be taken personally in hand as a whole by the Captain or Major. The mounted parades will be devoted to "field movements" on the drill-ground; tactics and the

conduct of artillery in the field being carefully avoided for the present. The afternoon parades are for Fire Discipline, ranging, and battery gun drill, and should be supplemented by lectures. When these subjects are thoroughly mastered on the barrack-square they may be transferred to the drill-ground, but it is essential that the greatest care be taken to ensure the thorough training of the various parts of the battery before this instructional promotion takes place, for the premature combination of manœuvre and Fire Discipline will only waste the all too-scanty valuable time which the mounted battery spends on the drill-ground (owing to the necessity of correcting errors that should previously have been elimated), and mistakes may easily creep in unobserved and gradually crystalise into bad habits demanding much time and care to eradicate.

We must here, therefore, retrace our steps somewhat to consider the subjects of laying, ranging, and control under fire which, though of at least equal importance with gun drill proper, have been passed over in silence up till now owing to their concerning the smaller number.

Layers.

The training of layers is duly prescribed by regulation, but the present system of their qualifying once yearly is not sufficient to ensure that degree of reliability and rapidity which is so necessary. The consequences of a ranging round being wrongly laid (or set) may be so disastrous in their effect on the rapidity with which the battery is ranged—for ranging, once the enemy opens an effective shrapnel fire, is admittedly almost impossible—that it behoves us in peace time to organise victory as far as may be and reduce the possibilities of error to a minimum.

Many men who lay excellently in barrack-square or on drill-ground are, from nervousness, very liable to error in the excitement of action or even the calmer joys of service practice ; and the only way to procure sureness and accuracy is by constant practice, resulting in almost mechanical manipulation. A layer should be so familiar with tangent scale, telescopic sight, and clinometer that the elevation or range are set almost by instinct, and the gun laid almost without the necessity of thought. The following system has been tried and seems to produce very satisfactory results, as far as it is possible to judge.

There is a weekly examination for trained layers consisting of six rounds according to regulation, and the results are kept in a battery register, not only the marks being noted, but also any causes of failure, such as inaccurate setting or laying, or over time. Success dispenses from re-examination for a fortnight, but failure to qualify entails joining for a week the standing class for the training of would-be layers. In one respect only does this periodic examination differ from the regulation one for the qualification for layers : two rounds of indirect laying with clinometer and aiming picket—one round in front and one round in rear—are substituted for two of the rounds with direct laying, so that two rounds are laid with tangent sight, two with telescopic sight, and two with clinometer. After very little practice the time allowed

for direct laying is found ample for indirect, the picket being, of course, previously put out.

The regulations at present in force recognise and reward one layer per sub-division, and prescribe the training of two more. This number is not sufficient. Our home batteries are at best peace cadres, and the reservists that join on mobilisation will certainly not be layers; but any how the proportion is far too small, for even were a battery in action reduced by casualties to the minimum number by which it could still be worked—two per gun—one of them, at least, should be a trained layer. It would seem desirable, therefore, to encourage the training of a far larger percentage of layers. The unpaid specialist plays, however, a lone hand, and his qualifications procure for him merely extra toil and no corresponding advantage. Would it not be possible to encourage qualified layers by the granting of a worsted badge? The cost would be inconsiderable, and there would still be ample distinction between the proud winner of the golden L and pound and the humbler worsted-wearing brethren of the craft. An additional advantage would be the ease with which trained layers might be recognised in the height of action should casualties disable those already laying the guns.

Whatever means be adopted to train and encourage layers, they are indubitably specialists, and their training should continue the whole year through irrespective of the stage the battery instruction is in. This, however, should in no wise absolve them from the obligation to take part and qualify in all other subjects.

Ranging.

Judging by the small number of pages devoted to the subject in the drill manual, it might almost be supposed that the ranging of a battery and the regulation of the length of fuze are simple matters, requiring but little previous practice, and needing merely the observance of a couple of well-known rules. This is far from being the case. The multiplicity of natures of target, the conditions under which the battery attacks them, the variety of sights (including the clinometer), the errors of the day, the various projectiles used, the casualties probable on service and the errors likely to occur in observation of fire, all tend to render the task of the regulation of the fire of a battery a most complicated one, needing much practice and absolute familiarity with the rules and range table.

No case should be able to present itself which has not already been anticipated and thoroughly studied, and the fact that modern Fire Discipline centres all control in the Battery Commander's hands makes it all the more incumbent upon him to thoroughly study and master every possible phase of the problem. Ranging, however, with the kindred subjects of fuze regulation and change of fire from one target to another, does not require to be studied in its more elementary stages with the whole of the *personnel* of the battery, and great benefit may be derived from the practice of ranging-drill in the lecture-room.

For this are necessary an officer to conduct the instruction and one to act as Battery Commander, as well as non-commissioned officers to

act as Section Commanders and "Nos. 1." A blackboard is required, and it should be ruled with white paint so as to roughly represent the battery practice report.

The instructor sets a problem, consisting of a certain target on which fire is to be opened, and gives an estimated range varying more or less from what it is to be ultimately verified at. He also personifies the observer, and calls out "plus," "minus," or "unobserved," as well as the height of the time shrapnel burst, having previously prepared for himself for each series a memorandum somewhat as follows :— "Series 1. Error of the day : + 150 yds. Fuze error : $-\frac{1}{2}$. Rounds unobserved : 2, 4, and 7. Incorrectly observed : Round 1. Fresh target after round 14." Its contents should naturally be only communicated to the Ranging Officer in the subsequent consideration of the series.

The tasks set should begin with the simplest targets, such as standing ones with easy observation ; these being followed by ones with more difficult and faulty observation, and others moving at various rates. When these single targets are thoroughly mastered each series should include the change of fire to a fresh target in the middle of the series, and without interrupting the fire save the delay necessary merely for the giving of the words of command.

A discussion should come at the end of each series ; the errors made should be pointed out and stress should be laid, not only on correct ranging and fuze regulating, but also on the correctness of the words of command given. There is much room for improvement in these last when fire is switched from one target to another, especially in the description of the target. Not a single necessary word should be omitted ; not one superfluous one inserted. Clearness and conciseness are of supreme importance. The best way of considering each series is for the commander to report what he was ordered to do, what he did, and his reasons for departing from any rules according to the necessities of the case. After this some other officer present may be asked to give his opinion on any special point, and the instructor then makes his criticism. There will, doubtless, be many points where the correct course is a mere matter of opinion, but in most cases the results will decide the point, and the officer making the mistake will often be the first to recognise it.

The ranging should be done without reference to the range table or use of note-book. Very little practice will enable officers to remember the elevations and fuze for the round numbers of the range table, and to rapidly apply the rule for interpolating the intervening angles and lengths of fuze. The use of a note-book by the officer ranging is much to be deprecated. It is unlikely on service, and every effort should be made to train the memory so as to be absolutely independent of it. The advantage of the non-commissioned officers taking part in this ranging practice is that not only do they get to thoroughly understand every move of the game, but also qualify themselves to replace casualties if need be among their superiors.

Fire Discipline may now be practised by the battery in the same manner on parade, familiarity with the rules and the range tables hav-

ing thus been acquired. Miniature targets on a scale of half-an-inch to a foot and placed at the other side of the barrack-square may well be made to thoroughly represent objects as they would appear in nature at medium ranges. Simple arrangements of springs released by a string may bring into view previously invisible targets, and men may be told off to represent targets moving on the battery and started at a signal from the Instructing Officer.

The variety of problems that may be set—all needing to be differently treated—is almost infinite. Targets may be prone, standing, or on horseback; halted or moving at a walk; trot or gallop; shallow or deep; ranged with shrapnel or common. Distribution of fire should be also practised, rules being laid down for the more ordinary cases, such as infantry in firing line or blocked in a defile, artillery in equal, inferior, or superior strength, etc., so that the command to "distribute the fire" will usually be amply efficient without any additional explanation or order as to how it is to be done.

The examples in the drill-book and the procedure of many Commanding Officers at battery gun-drill are based on the assumption that but few ranging rounds will be insufficiently, and none incorrectly observed. This, with targets of ordinary difficulty, is more than can be counted on, the proportion being much nearer 10 per cent. incorrect, and 20 per cent. doubtful. The battery should, therefore, be prepared for the incidence of misleading rounds, and once the more simple cases are thoroughly understood the occurrence of one or more incorrectly observed rounds should be made a feature of every series. Once this has ceased to cause any difficulty yet another step in advance should be taken, and casualties should be ordered among the *personnel* as well as the execution of petty repairs in the middle of ranging. When, finally, these even produce but little interruption or confusion in the fire, there is fair ground that the Fire Discipline has reached a satisfactory pitch of excellence.

This eminently satisfactory result will, however, even with great skill and care, be hardly reached before the end of May, and by this time the instruction of the battery mounted (*i.e.*, the contents of Volume III. "Field Artillery Drill," less section five) should be practically complete. The time has, therefore, come for the second, or mounted portion of the Lieut.-Colonel's Annual Inspection, which precedes the portion of the year devoted to minor tactics, field days, and manœuvres. From this date on, all parades of the arm by itself (save the smaller ones of specialists, 2nd class men, and recruits) should be brigade division ones, and these should take place not only on the drill-ground, but also occasionally in the barrack-square, where Fire Discipline in brigade division should be practised on lines very similar to those advocated for the batteries, each parade ending with a short *critique* lasting only for ten minutes perhaps, but still long enough to point out errors and lapses and the means by which their recurrence should be avoided.

The advancing wave of progress in this matter of Fire Discipline would seem for the present to have reached its high-water mark with the Majors, and "their yearly improvement in ranging, observation of fire, and fire tactics generally, though tangible, is not so marked as the

progress made by their commands." This is natural enough: the Battery Commander is the teacher, and how shall Gamaliel sit at the feet of Gamaliel? The matter must, however, not be allowed to rest here, and Brigade Division Commanders must recognise their responsibility for the training in Fire Discipline of their more immediate subordinates. One matter alone and that of great importance, the observation of fire namely, is beyond their control, for this can only be learnt in Practice Camp. A little more might, perhaps, be done to ensure efficiency in this respect, and the gunnery courses recently inaugurated at Okehampton are most beneficial, and it is much to be hoped that all field officers may be able to attend them at least every two or three years.

With the training of the Commander in observation of fire, the subject of battery Fire Discipline ends, for the difficulties attending the fire control of large masses of artillery are obviously a development outside our present limits.

MOUNTING HYDRO-PNEUMATIC DISAPPEARING GUNS.

BY

CAPTAIN L. C. M. BLACKER, R.A.

As large numbers of these mountings are destined for coaling stations and fortresses in nearly all our possessions, it may be of interest to some of the readers of this periodical to detail the process of putting the platform and carriage together, and raising the gun and shields on the same.

In the first place it will be found that, as a rule, so little room is left in the central pit in which the roller ring rests that it is practically impossible to use jacks underneath the platform, and thus all the lowering must be done by overhead lifts with tackles, and altogether the mounting when fitted together is of such an awkward shape that considerable care is necessary throughout each step of the operation. The first thing to be done is to fit the live roller ring together in its place. This presents no difficulties, care being taken that each of the rollers bears accurately on the upper surface of the racer. Baulks are then laid across the pit and each of the segmental pieces composing the platform is moved into position. This may be done on rollers, but as an overhead lift will be required for the buffer of the heavier natures of guns, it will be as well to first plant the cheeks of a heavy gyn in position between the pit and the front of the emplacement, and fit it with a heavy gyn tackle and a back guy. The feet of the gyn must be placed close up to the edge of the central pit so as to give room for the levers to work. Even then the lever numbers will have to haul on the ropes from the top of the parapet. Fitting the trunnions of the buffer into the side pieces will require some management. The platform, elevator, and buffer having been put together, and the piston connected, the next step in the operation is lowering the whole mounting on to the roller ring. For this purpose an overhead lift presents the great advantage that it will enable the platform to be swung sideways if necessary so as to drop easily into its place when lowering with jacks, not to mention the difficulty in working in the confined space ; it will be found very hard to move such a heavy mass even an inch or two sideways in order to get the upper racer between the flanges of the rollers. Care, of course, is taken to follow up underneath with skidding so as to avoid damage in the event of a fall parting during lowering down.

The slings can be passed down through the holes into which the standards for the shield fit. There is no necessity for connecting the

heads of the gyn cheeks together by means of the pry-pole or uphirs, though a check-rope will be found advisable from one upper cross-bar to the other to prevent the cheeks springing over backwards were the main tackles to give way. As soon as the upper surface of the platform is flush with the concrete floor of the emplacement, steps can be taken to parbuckle on the gun.

Now there are two methods of doing this. If the emplacement pit is completely circular in form it will be found easiest to put up the shields first and skid them up underneath from the gun-floor. The elevator is then raised with jacks till the trunnion holes are above the shield and the gun parbuckled straight off the edge of the parapet to the trunnion holes.

If the emplacement is semi-circular and open to the rear, the gun may be brought on skids from the ground before the shields are fitted, and considerable care exercised in building up under the baulks, which must be at least 15 inches in section for a 9·2-inch gun.

Heavy and light drugs well lashed together, and supported under the transoms, will be found very useful in economising short skidding and in saving labour in piling up the four-foot and six-foot pieces. Two 30-ton jacks will be required at breech and muzzle respectively, and greased scotches on which to slide the gun forward into the trunnion holes are easier to use than short rollers.

The shields are swung on with a swinging derrick, and as each section has a ring (too small, as a rule, for a heavy gyn-tackle hook) rivetted on at its centre of gravity, there is little difficulty in getting on the shield after the derrick is once up. Care must be taken to place the foot of the upright spar (which is best against the wall of the parapet) clear of where the edge of the shield will come when fixed. Of course, if the pit is closed in, the main spar must be placed above on the top, and a shorter one will suffice. The platform can, if necessary, be traversed round for each quarter of the shield, which must be supported by a trench cart or other means, if that is done instead of heaving up the swinger (this latter would necessitate two capstans or a crab winch, and is a tiresome plan).

Bolting the sections together takes a little time.

Care must be taken before putting up the gun and the shields that all the clip plates work properly, as otherwise the gun may not traverse. New plates may have to be made, or the platform raised again, and the racer re-levelled and altered.

Filling the buffer is easily done with reservoirs of compressed air.

Note.—In the foregoing paper the term pit is held to mean the circular depression in the middle of the gun-floor of the emplacement. In this the platform traverses, and the bottom of the pit is shaped like an inverted truncated cone round which the lower end of the H.P. buffer revolves.

Two gyn cheeks are used for lowering the platform containing the buffer and elevator, etc., and their feet are placed close up to the pit.

If it is found necessary to raise the platform, etc., and gun, minus the shields, for any purpose, it can be done by placing a 30-ton jack under the muzzle and breech, fixing the gyn cheeks in position and raising gun and platform alternately a few inches at a time till clear of the centre pit. Two 15-inch baulks can then support it all, one being just in front of the centre and strutted up with a six-foot piece and the other further back towards the breech.

ACHIEVEMENTS OF FIELD ARTILLERY.

BY

MAJOR E. S. MAY, R.A.

PART IV.—Chapter I.

The Renaissance.

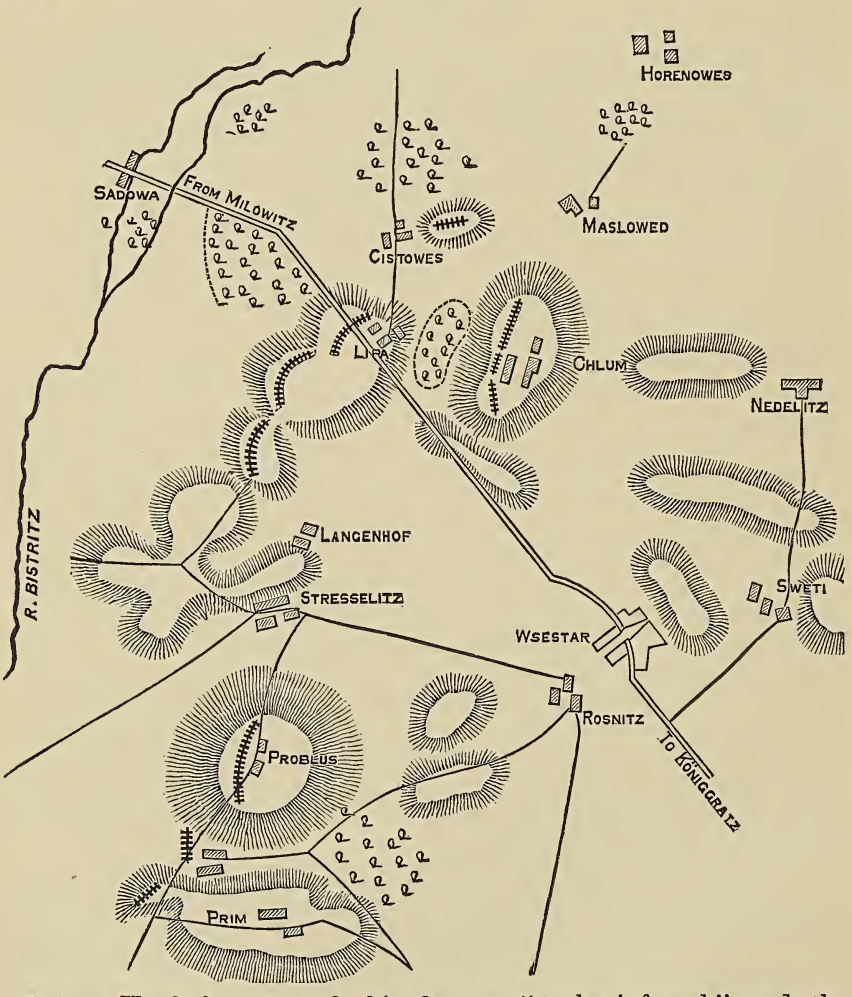
The short and decisive struggle between Prussia and Austria, which is the next war to engage our attention, is not distinguished by any very striking performances by the artillery on either side. The Austrians had perhaps somewhat the advantage as regards armament, for all their guns were rifled, whereas on the Prussian side six out of every ten batteries were still equipped with smooth-bores. The Austrian guns, however, were muzzle-loaders of an inferior pattern of rifling, had but indifferent fuzes, and a shrapnel shell whose performances were most uncertain. The newer Prussian pieces on the other hand were rifled breech-loaders, and were certainly superior as regards accuracy and effect of fire to those on the opposite side.

While, however, a large proportion of the Prussian *matériel* was better than that of their enemy's, the tactics with which their guns were handled were distinctly faulty. So it has come about that while the Austrian artillery emerged from the campaign with the reputation of being the best arm of their service, and although it could not gain the victory, still accomplished a great deal towards minimizing defeat, the Prussian gunners were reproached for the little they had done, and could look back with no satisfaction even on a campaign so decisively victorious as that of 1866. The Prussian rifled guns being capable of producing effect at long ranges were kept at them in order that they might enjoy the full advantage of their superiority. Their practice was indifferent, and showed a lack of careful training in peace time, and to crown the errors of their leaders, not only were they held so valuable that they were kept in cotton wool during the action, but for fear of accidents were likewise placed in safe positions far to the rear on the columns of march. There was in short a general lack of enterprise about the manner in which guns were handled, and the secret of the arm had clearly been forgotten.

Austria, on the other hand, relied much on her batteries to counteract the inferior armament of her infantry, and from her experiences against the French in 1859, was not inclined to overlook the value of employing guns in masses. Therefore, although Königgratz ended in a fatal defeat for Austria, and although perhaps the Austrian artillery can scarcely be said to have on that day performed a great achievement, it is none the less instructive to mark how much their guns effected,

and how the stubborn front they showed must at one time have caused grave anxiety to their opponents, and made them feel that but for the opportune arrival of the Crown Prince, the Prussian infantry, inadequately supported as they were by their artillery, would have had to renounce their enterprise as hopeless.

The Prussian 8th Division, which crossed the Bistritz and assaulted the wood at the foot of the opposite heights crowned by Austrian batteries, was for two hours unable to make any headway against the fire which was poured upon them, and tore through their ranks with awful effect. The Austrian infantry were no match, even with their favourite bayonet, for their opponents, but as they drew back their guns took up the fight, and the Prussians suffered fearfully and were stopped.



Prince Kraft has termed this fire as "truly infernal," and the strength of his language is borne out by other accounts.

Hozier says "at this time the Austrian artillery were making splendid practice, and about one o'clock the whole battle-line of the Prussians could gain no more ground, and was obliged to fight hard to maintain the position it had won. At one time it seemed as if it would be lost, for guns had been dismounted by the Austrian fire."

And when Prince Frederick Charles sent the 5th and 6th Divisions forward to support the attack, they were unable to make any progress either. The counter-attack which might have followed on the resisting power developed by a powerful artillery was, as we all know, stifled by the pressure on the Austrian right, and the end was soon inevitable; but during the remainder of the disastrous day the Austrian batteries nobly sustained the reputation of the arm, and staved off ruin though they could not bring about a victory.

The guns which had so long held the 1st Prussian Army at arm's length in the wood of Sadowa were captured, it is true, but not until the troops which were supporting them had disappeared and almost the whole of their detachments and teams had been destroyed.

Von Moltke[1] himself has borne testimony to their devotion in the following words :—

"As we came out of the wood of Sadowa we found still a part of the great battery which had so long prevented us from debouching there, but *the teams and gunners lay dead* by the wrecked guns. There was nothing else to be seen of the enemy for a long way round."

The Austrian retreat from the position, stormed on both sides, had become inevitable, and had, in fact, been effected some time since. Their capital artillery, firing on to the last moment, had screened their retreat, and given the infantry a long start.

The Austrian batteries which were held in reserve behind the centre of their position likewise did excellent service, when it was clear the day was lost, and when the Prussians, pressing on triumphantly, both in front and on the flank, threatened to cut off the retreating masses of their opponents from the bridges across the river behind them. All accounts concur in praising the courage and self-sacrifice displayed at this period of the battle by the Austrian artillery. The 1st and 2nd Divisions of the Reserve Artillery were brought into action between Chlum and Nedelitz about two o'clock to oppose the menacing advance of the 2nd Army under the Crown Prince from this position, and from two others which they subsequently retired into in rear, these eight batteries did all that was possible to hold back the enemy, and by the splendid spirit of self-sacrifice which they displayed averted the utter ruin which the Austrians would otherwise have experienced. Taubert[2] says that but for the unflinching front shown by these guns up to the last moment the catastrophe might have been immeasurably greater, and something like total destruction would have fallen on the beaten army. Yet, covered by their fire, Benedek succeeded in drawing off his troops still in formation across the Elbe, and nothing like a rout supervened on the defeat. According to Taubert these eight batteries lost 9 officers, 139 men, 259 horses, and 32 guns.

[1] In the appendix to the "Franco-Prussian War."

[2] "Der Gebrauch der Artillerie un Feld Kriege."

While, however, it seems just to notice the important assistance which the Austrian batteries thus lent to the other arms, it cannot be denied that the destructive effect produced by the guns, either of the victors or the vanquished, was unequal to what had been expected from rifled cannon. The inferiority of *matériel* on one side, and the faultiness of the tactics on the other, are sufficient to account for this, and it must be remembered that the effect which the new improvements would produce was at first but little understood, and that ideas were as yet in solution on many points connected with the handling of the arm. In the next great war we shall find that sounder and clearer views have been precipitated, and the principles on which guns should be handled well understood, though manufacture is still unequal to completely realising the intentions of those who stand behind the sights.

What makes the performances of the artillery in 1870–71 peculiarly interesting, however, is the fact that the guns were called upon to restore the balance the superiority of the Chassepôt had brought about. That rifle had an initial velocity of 1328 f.s., as against the needle gun's 990, and was effective at 1800 yards, while the other was no longer so beyond 600. The new weapon could be fired ten and a-half times per minute, the old one only seven and a-half times, and the smaller cartridges of the Chassepôt allowed of more rounds being carried by the soldier.

The French guns, on the other hand, were chiefly bronze muzzle-loaders of the La Hitte pattern, with a time fuze so faulty that it could only act at two ranges, 1500 and 3000 metres, and rendered the shrapnel they carried practically useless. The Germans had breech-loading guns of better shooting capabilities, and although they had no shrapnel, except the inferior one to some extent made use of by the Bavarians, they used a percussion fuze, which acted far better than the time fuze on the other side. It was not, however, superior *matériel* so much as wiser tactics and better training that enabled their batteries to overwhelm those of their opponents, and to counteract the effect of their deadly rifle. Their guns fired deliberately, ammunition was never wasted for the sake of the sound produced, and shots told because each was calculated for. The higher direction of the arm was equally sound, and a concentrated effect was always sought for.

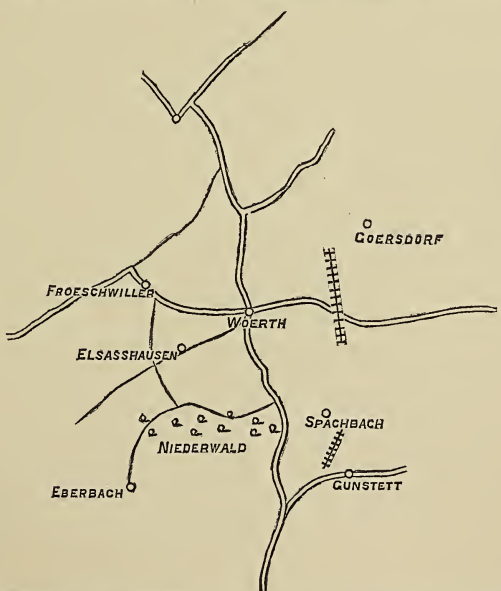
The lessons of 1866 had been well digested, and a combination of better guns, better tactics, and the confidence engendered by success was enough to give them a decided superiority over their rivals whenever they met. The glories of the golden prime of Senarmont and Druôt seem again revived, and masses of guns play a prominent share in all descriptions of the battle-fields of 1870.

Of what may be justly termed artillery achievements, there is in consequence a positive *embarrass de richesses* in the records of this great war, and the arm contributed largely to almost every victory. Yet, since it is comparatively easy to succeed when all the odds are in your favour, it may be urged that it is possible to make too much of performances effected under such conditions, and that suspicion lurks about deductions drawn with too much confidence from experiences like these.

The persistance which guns have shown in facing superior odds undauntedly, the unselfishness in which they have stood between their defeated comrades and the pursuit, or the fearless enterprise with which they have gone forward to their assistance or to the attack, have all been exemplified in the previous pages, and it is on achievements carried through by spirit, skill and courage, rather than those rendered possible by superior strategy or *matériel*, that we would here rather dwell. We trust however that we shall be able to show that, if the German gunners played a winning game well, they did not on many occasions fail also to evince qualities which would have been equal to a less one-sided contest.

An idea is, in fact, somewhat widely spread in this country that the Germans always fought with the "big battalions" on their side, and that their victories did not therefore demand the same devoted sacrifices that are usually called for. This, however, was by no means the case, as we shall presently point out, and in the majority of the battles we shall deal with, the odds were considerably against them, while in all, at certain localities the invaders had to face superior numbers. The guns which played so conspicuous a part were at times called on to make unusual exertions to restore the balance rather than preserve it, and had, moreover, habitually to contend against an infantry armed with a weapon which was immensely superior to that of their own side, and, as a military fire-arm, left little to be desired.

It is these occasions that we would chiefly emphasize, and we will pass over therefore what was effected by the 66 guns with which, at Weissenburg, the Germans hammered their opponent's position, nor will we pause to accurately weigh the precise value which the conquerors at Woerth derived from the great mass of 108[1] cannon which



[1] 24 guns of the advanced guard of the 11th Corps, and 84 of the 5th Corps, which practically formed one mass. Official account, Part I., Vol I.

covered the deployment of their battalions. The effect produced by what was practically one great battery was admittedly enormous, and has been quoted almost *ad nauseam* by every recent writer on the tactics of the arm; but later on in the day, when the infantry attack on the Niederwald came to a standstill, guns pressed on to their support in a fearless manner, such as belies the value of deductions based on musketry returns, and deserves record as a notable achievement of the true romantic type.

Prince Kraft has quoted this example of how widely the German artillery tactics of 1870 differed from those in vogue during the previous campaign, and gives the following account[1] of what took place:— "When the infantry found itself prevented by the enemy's fire from continuing its advance from the northern edge of the forest, the artillery was pushed out to the front. Eight batteries came into action in the very thickest of the infantry fire, and supported the attack which was directed against Elsasshausen, just as later on they assisted the infantry to repulse the counter-attacks of the enemy; on this occasion they many times fired case in place of shell. Between three and four p.m. 13 batteries had already been hauled up the scarped heights on the other side of the Sauerbach and prepared the way for the attack on Froschwiller with the fire of nearly 80 guns at a very short range. At this point single batteries advanced in front of the line of skirmishers attacking the village. . . . . During the pursuit in the evening the artillery still supported the other arms at all points."

On the same day on which was fought the battle of Woerth (the 6th of August), another combat was also taking place at Spicheren, where, however, numbers were on the side of the French, and here, too, the German artillery evinced an equally daring spirit, and genially came to the support of the infantry without attempting to avail themselves of the safety which their superior range might have assured them, had their own freedom from loss been a first consideration with them. To recapitulate the performances of the different batteries would be almost to write the entire history of the day, but one special achievement deserves a separate mention.

When the struggle was at its fiercest, soon after six o'clock, we find Colonel von Rex, commanding the 32nd Brigade, particularly begging for the support of artillery to give more decisive effect to the successes which had already been effected on the Spicheren plateau by the infantry, who now, worn out by their exertions, were clinging with difficulty, almost exhausted, to the ground they had captured. In response to his cry for aid, General von Bülow ordered up the 3rd light and 3rd heavy batteries of the 9th Brigade to the heights. The road by which these batteries endeavoured to advance was at all times a difficult one, but now ploughed up as it was by shells, and partially blocked by some cavalry who had preceded the battery and halted in their path, was well nigh impassible.[2] The leading gun of the light battery was alone

[1] 2nd Letter on Artillery.

[2] Prussian Official account. Part I., Vol. I.

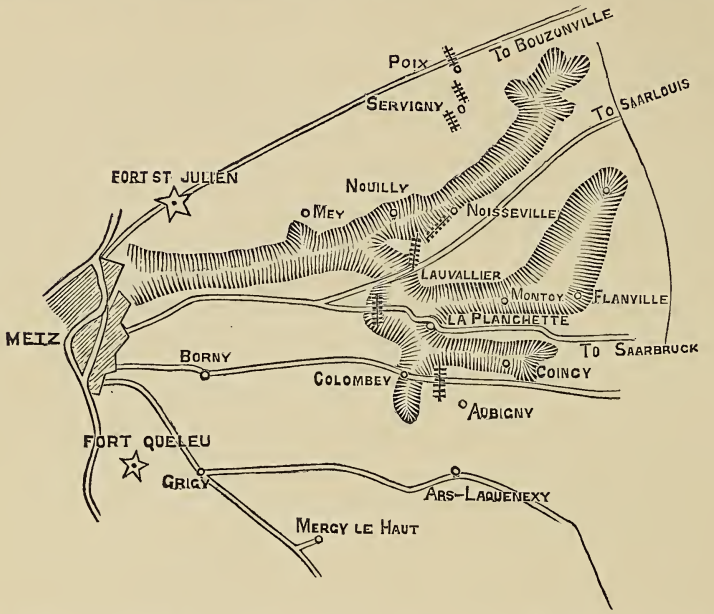
able at first to reach the heights, and their anxiously waited-for appearance was greeted, we are told, by a loud cheer from their hard pressed comrades of the infantry. Soon after the rest of the light battery was got up, but only one division of the heavy one could reach the position they were striving for.

Although these eight guns lost nearly half their gunners, fighting as they were within 800 yards of a line of French skirmishers in shelter-trenches, the effect of their shells compelled the enemy by degrees to abandon the field, and the remaining four guns of the heavy battery were able then to come into action too, and added their force to the fire which was overpowering the foe. The action of these two batteries can hardly be said to have been absolutely decisive of the fate of the day; it remains, however, none the less true that their timely and bold advance up a road that was considered impracticable for Field Artillery, and the glorious struggle maintained by them had a most marked effect on this particular phase of the engagement, and but for their opportune appearance the Germans might have lost the Rotherberg. As it was, the possession of the hill was assured to the ultimate victors by this brave effort on the part of their artillery.

During the battle of Borny, or Colombey-Nouilly as it is also called, where the Prussians with 64,000 men and 32 batteries opposed the French with 88,000 and 38 batteries, the German artillery showed the same enterprise in coming into action which had distinguished their conduct at Woerth. Like many of the other actions of this campaign, this battle grew out of an impetuously venturesome reconnaissance in force made by the advanced guard of the 7th Corps, commanded by Von der Goltz, and the artillery at the head of the columns of march were hurried on fearlessly ahead to support the two batteries which had at first engaged the enemy. Prompt assistance was required; the German guns were ready and able to move when called for, and pressed to the front to come into action as quickly as possible, even if they were thus compelled to detach themselves temporarily from the bodies of troops to which they were attached.

At 4.30 p.m., that is about an hour after the first shots were exchanged with the enemy, 30 guns of the 8th Corps were in action, an hour and a-half later double that number were in position, the guns belonging to the main bodies of the 13th and 1st Divisions having trotted on in front of the infantry. Very soon afterwards the whole of the artillery of the 1st Corps, hurrying on in generous rivalry, were on the scene, and thus in the very opening of the battle the greater part of the German artillery was employed, everywhere they prepared the way for the advance of their infantry, and moved forward with it as the attack progressed. Where all did well it is almost invidious to select some for special approbation, but the action of the five batteries, two light and two heavy Field Batteries of the 1st Corps, and one heavy Field Battery of the 7th, which, between the defiles of Montoy and Coincy, pressed on across the defile of La Planchette in front of them to the aid of the 55th and 43rd regiments of infantry, which had made a brilliant onset on the enemy's position in front, but which had now run short of ammunition, certainly claims our attention.

Captain von Horn, who was in command of these guns, seeing the difficulties of the infantry, and anxious to give a fresh impulse



to the battle, decided to take them across the difficult ground before him in echelon, and establish them on the other side of the defile.[1] The batteries were got over successfully and, except in the case of one battery, the 2nd heavy, which had two of its gun poles broken and was consequently delayed, without much loss, and were placed astride the Saarbruck road, 300 paces in rear of the foremost skirmishers. From this advanced position they shelled the enemy's infantry and artillery with good effect at ranges of between 900 and 1300 paces. Hoffbauer says this artillery suffered little from the enemy's artillery fire, as the French fired their shrapnel with too much elevation, and in his general observations on this battle he alludes to the services of these batteries as "pre-eminently conspicuous."

These guns indeed advanced to shorter ranges than any other that took part in this day's fighting. The moment was a decisive one, for it was imperatively necessary to send succour to the hard pressed infantry, and considerations as regards effect of fire were held of more importance than cover for the detachments. The batteries consequently lost heavily, and that, too, within the space of a few hours.

We must bear in mind that the really combatant part of a German Field Battery then numbered 4 officers, 62 men, and 48 horses. The losses, according to the tables given by Hoffbauer, show that four batteries of the 1st Division of the 1st Corps had 4 officers (including Major Munk in command of the four batteries) severely, and five slightly wounded; 5 non-commissioned officers and men killed, and 54

[1] Hoffbauer's account.

wounded, and 34 horses killed, and 31 wounded. The battery (6th heavy of 3rd Division) of the 7th Corps which joined them lost 3 men killed and 10 wounded, and 7 horses killed and 11 wounded. The five batteries fired respectively 163, 124, 302, 280, and 182 shells, and one fired also 6 case shot.

Hoffbauer also specially dwells on the conduct of the artillery mass formed of the Corps Artillery of the 1st Army Corps, and a battery of the 3rd Field Division, which was also joined in their last position by two Horse Artillery batteries of the 7th Corps. While in their first position these guns, with their concentrated fire, materially assisted the infantry by preparing their assault on the heights west of Lauvallier, while from the second position, which they took up further to their right, they and three batteries of the 3rd Field Division were to a large extent instrumental in forestalling the attempt of the French to overlap the German right. Owing to the manner in which the French left was hammered by these batteries, it needed but very little pressure to make their infantry retire.

The batteries, we are also told, came into action at very different ranges, varying from 800 paces—"reduced by the offensive thrusts of the enemy to 400 and 500 paces"—up to considerably more than 2000 paces.

While it was merely necessary to keep the enemy at bay during the commencement of the battle, and the artillery were ahead of the infantry, owing to their superior mobility, the greater ranges prevailed, especially so when dense columns of the French moving up from their rear offered a favourable target, but "when it was desired to create a *decisive* effect the batteries showed their eagerness to prepare the attack of the infantry by taking up positions closer to the enemy."

The batteries of the victors may point with pride to the words in which Von Moltke has spoken of their actions:—

"A large share of the success of the day must be attributed to the artillery. Hurrying along in front of the advanced guard, the artillery aided them very effectively in driving the French from their position before Metz, and driving them back under cover of its forts, even before the main body had time to come up."[1]

Two days after the battle just referred to, the French, had they utilised their opportunities, might have been out of their opponent's reach on the road westwards from Metz towards Verdun, but at nine o'clock, on the morning of the 16th, the 5th German Cavalry Division were able to surprise the bivouacs of Forton's cavalry round Vionville, and their four Horse Artillery batteries commenced shelling the French camp from the Tronville heights.

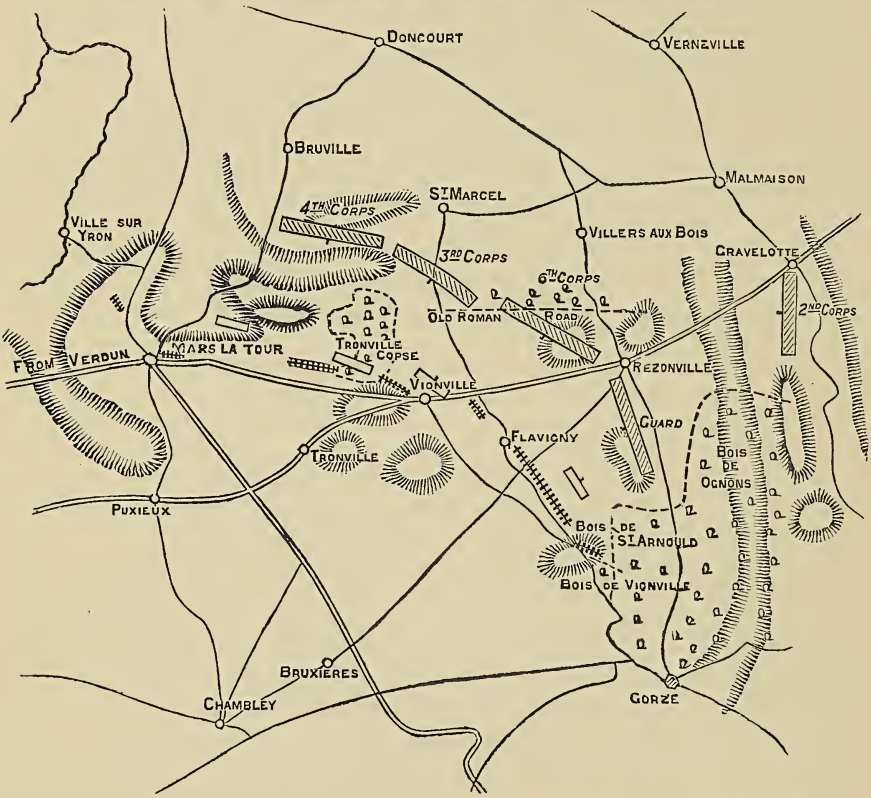
Von Alvensleben, commanding the 3rd Corps, with the instinct of a soldier, and a magnificent rashness only justified by the occasion, decided at once to send forward the 6th Division, with the 6th Cavalry Division to the attack. The Divisional Artillery of the 6th Division was hurried on into action to assist in the attack on the enemy's camp, and the Corps Artillery was also ordered forward as soon as possible.

The effect of the shells of the Horse Artillery batteries which first

[1] "Franco-German War." Vol. I.

came into action was to throw the French camp into a great state of confusion. But the French infantry soon formed up and, undismayed by the panic amongst their squadrons, pressed on in superior numbers, and driving in the German cavalry, gained possession of Vionville in spite of the heavy fire from the German Horse Artillery batteries, whose situation as the skirmishers crept on towards the heights south of the village became so critical that they had to be withdrawn.

BATTLE OF MARS-LA-TOUR, VIONVILLE.—16th August, 1870.



In place of having met with a mere covering force or rear-guard, Alvensleben had stumbled on vastly superior French forces, and their weight threatened to overpower his daring assault.

The enemy must be held back by the arm most endowed with mobility and fire effect, and all the guns available were therefore hurried forward to grip him firmly. Thus it was that a battle, the results of which had, strategically speaking, the most far-reaching consequences, and eventually led up to the surrender of Bazaine, was commenced and sustained by artillery predominantly throughout the day.

At 10 o'clock the four batteries of the 6th Division arrived, at 10.30 the two Horse Artillery batteries of the Corps Artillery came up, and an hour later its remaining batteries of Field Artillery. The Divisional

Artillery of the 5th Division soon joined itself on to these, and also a battery marching with Lynckei's detachment of the 10th Corps. This great line of guns, numbering 21 batteries, stretched from the Bois de Vionville along the heights to Tronville. Some of the batteries which composed it had to defend themselves against the attack of the hostile infantry without the assistance of any other arm, but, as the German infantry gathered weight, the French, though fighting most stubbornly, fell back; were driven out of Vionville, and the great artillery line wheeled forward pivoting on its right till the left flank rested on Flavigny, which was captured at noon.

But although it was the infantry who actually captured this place, that they were able to do so was due to the artillery,[1] for when Colonel von Dresky[2] arrived on the scene shortly before noon with his five batteries, he led them forward under a storm of bullets from the buildings, part of the way at a gallop, to the hill south of Flavigny, and his shells soon set fire to the place. These batteries and the others close to them now concentrated such a fire on Flavigny and the woods near it, and on the French guns placed on either side of the road for their defence, that the wood was carried by the Prussian infantry without much difficulty. Two French columns which emerged from the farm buildings were shelled by the batteries at a range of from 1500 to 1600 paces, and retreated on Rezonville, "leaving the ground literally covered with corpses; while strong French columns which advanced from the hill to re-occupy the village met the same fate.[3] On the day after the battle an extraordinary number of French corpses, and a large herd of cattle, which had fled from the farms, lay on the ground in and about Flavigny torn and mangled by shells."

We cannot tell the story of what subsequently occured better than in Von Dresky's own words as given in Prince Kraft's letters:—"When the enemy had evacuated Vionville and Flavigny and retired on Rezonville, I advanced the whole of the Corps Artillery in echelons, and arranged my troops in such a manner that two batteries under Captain Stumpff stood together to the north of Flavigny, while the whole of the remainder were to the south of that place. The Horse Artillery was on the right, and its flank rested on the slope of the hill, marked 311 on the official plan."

"The left wing of the 5th Division was at this point; and here, on account of the excellent view to be obtained from it, I remained with Generals von Stülpnagel and Von Schwerin during the greater part of the battle. I occupied this position at 2 p.m. and remained there until 7 p.m. During this time the 2nd Horse Artillery Battery, which had been attached to Rheinhaben's division, and the first 6-pr.

[1] The independent manner in which the guns held their ground is vouched for by the following words of a high authority, as quoted by Hoffbauer:—General Von Bülow states "that from the time of the capture of the farm of Flavigny, up to that of posting the outposts in the evening, there was not a single infantry soldier within reach of the artillery in the centre, or, in other words, from the position of the Corps Artillery on the hill as far as that of the 4th heavy Field Battery near the high road; the farm of Flavigny alone being occupied by two companies. The artillery was consequently obliged to defend itself against the attack of the enemy's skirmishers, which was done with perfect success."

[2] Commanding the Corps Artillery.

[3] Hoffbauer's account.

battery of the 5th Division came into line with the other batteries. Between 2 and 4.30 p.m. four Field Batteries and one Horse of the 10th Brigade also arrived in turn; they placed themselves under my command. As at first, I had placed my guns with very wide intervals, owing to the great extent of ground which I had to occupy, I had plenty of room for the batteries which joined me afterwards."

"There were therefore in position at Flavigny, at about 5 p.m., four Horse Artillery and seven Field Batteries. At this hour the Imperial Guard made an extremely violent attack upon us. We had six French batteries in front of us (I counted them several times), which for the most part fired salvoes on us. When the artillery fight had lasted about half-an-hour, the French infantry advanced to the attack. We could only see a very thick line of skirmishers. As for the troops in column in rear we could see nothing of them. Our fire was directed against this line of skirmishers as it advanced, and since we had been in position since 2 p.m., and knew all the ranges, our shells made such gaps in the enemy's line that it, after having very bravely approached to a distance of about a thousand paces, and having been received with a rapid fire, answered with a hurried and ineffective discharge, and then turned to the right about and retired."

"On this occasion I acquired the certain knowledge that a line of artillery cannot be beaten or broken by a frontal attack. At that time we had common shells only, and what an overwhelming effect did we not obtain with them. At the present day the artillery have shrapnel, and a frontal attack would be repulsed with even more terrible loss."

"The fight at Vionville has also made me sure that the only way to close open ground efficiently, is to employ artillery for that purpose, for the very reason that it cannot be driven back by a frontal attack. But such a line of artillery has a yet further use; it serves as a substitute for a reserve to receive troops which have been driven back."[1]

"During the alternate successes and failures of the infantry fight round the hill, marked 308 near Vionville, I often saw detachments which the enemy had just repulsed form up again immediately in rear of the line of artillery, for there they knew themselves to be in safety, and from thence they were led forward once more to the attack. We had no longer any infantry reserves."

"But, to return to Vionville, about 7 p.m. some batteries of the 8th Brigade arrived on the field of battle. They filled up the interval between my guns and those of the 5th Division. We had then from 20 to 24 batteries in one line. There was no fear that the French would ever force this. Consequently we had done exactly what General von Alvensleben desired. It was fortunate also that he had so much artillery there, for the *infantry was wasting slowly away in these terrible struggles.*"

Subsequently Von Dresky led forward the Corps Artillery of the 3rd Corps to Rezonville, where in spite of heavy losses they sustained from some hostile infantry "they came gaily into position and opened fire." The fight continued about twenty minutes and then the enemy's

[1] The manner in which Napoleon utilised his artillery at Wagram to reinforce his centre is an example in point.—*E.S.M.*

infantry ceased firing, and darkness put an end to the battle.

The losses sustained by the German batteries were heavier during this day's fighting than the whole of those hitherto sustained by them; according to the official account Von Dresky's Corps Artillery lost 10 officers, 119 men, and 219 horses. The two Horse Artillery batteries which formed part of it alone lost 139 horses, or 70 per battery.

Hoffbauer tells us that at this extremity of the line of battle the hostile infantry endeavoured repeatedly to advance over the hill to the north of Rezonville, but were always driven back by the accurate and destructive fire of these guns, while the French batteries were shelled with such effect that they were frequently unable to come into action.

But these observations, it will be objected, being those of gunners, may be coloured by prejudice springing from *èsprit de corps* and confidence in their arm. Let us add to them these, the utterances of Von Moltke, made with critical exactness in his history of the great war.[1] This is what he says—"Later in the evening, when the German attack emerging from the wood of St. Arnould on the heights opposite was repulsed, and the French assumed the offensive, it was the well directed fire of the Prussian artillery which forced them to retrace their steps."

Hitherto we have dealt chiefly with the deeds of the German artillery on the centre and right of the German position. No less effective, however, was the support afforded by their batteries on the left, where the French were utilising their numerical superiority to make a menacing advance, and where the ground was favourable to a counter-stroke.

The German batteries near Vionville were exposed to an enfilade fire from the French guns on the high ground south of Bruville, and two batteries had to throw back their left to engage them. Then strong bodies of French infantry begun to emerge from the Tronville copse, and the situation of the Germans became very critical, for the hostile rushes grew in force and frequency, and ammunition began to fail so greatly that all the guns were obliged to fire slowly, and some had altogether to be silent.

The arrival of the 10th Corps and the 20th Infantry Division, however, now began to make itself felt, and the four batteries of the 20th Division and Corps Artillery, under Von der Goltz, were soon hastening to the assistance of the troops already engaged. Von der Goltz led his two light batteries forward into action at a trot, dispensing with the services of an escort, and the fire of these guns, directed on the southernmost portions of the copse, repulsed a French attack, which was supported by three or four of their batteries. Von der Goltz moved up to the high road to get a shorter range, and drove off the French batteries, distant 1500 to 1800 paces. His losses, however, were very heavy—one officer was killed, two guns were rendered temporarily useless from want of gunners, and three lost so many horses that they could not be moved.

The pressure was, however, relieved, the heavy batteries and the infantry were beginning to appear, and the guns got into position along the road between Mars-la-Tour and Vionville.

At 4.30 o'clock the Germans were able vigorously to renew the contest

[1] "The Franco-German War," by Von Moltke.

on their left, and half of Schwartzkoppen's 19th Division—that is to say, the 38th Brigade, commanded by Von Wedell, made such a bold counter-attack against the right wing of the enemy that he was deceived into imagining that powerful bodies of troops must be in support of it.

This attack was prepared by the 2nd heavy and 2nd light batteries from the east of Mars-la-Tour. Von der Goltz co-operated with them, and led his two light batteries across the road to the high ground north and east of Mars-la-Tour. The 2nd heavy battery of the 10th Corps also succeeded in pressing similarly forward, and engaged the French infantry and artillery with good success at ranges of from 1000 to 1200 paces.

But the balance in numbers was too much in favour of the French, even if they hardly realised how much it was in their favour, reinforcements were near at hand, and soon twenty-six French battalions were opposed to five German.

The Germans, although they fought desperately, were driven back with a loss of 65 officers and 2600 men, out of a total of 95 and 4500 respectively.

Their opponents followed in hot pursuit and were soon crossing the ravine.

It was now that the German batteries, who had been so enterprising in the attack, showed themselves even to better advantage in retrieving the disaster. They remained firm on the ridge although the hostile infantry came within 400 paces of their guns, and the punishment they suffered was severe.

The losses of these batteries were as follows :—

	Killed.		Wounded.	
2nd Heavy Battery	1 man	4 horses.	13 men	10 horses.
5th Light ,, ...	3 men	20 ,,	24 ,,	—
6th ,, ,, ...	6 ,,	30 ,,	11 ,,	2 ,,

All the commanders of batteries had horses killed under them. Baron von der Goltz's horse was struck by five bullets, and Captain Lenz on his staff was severely wounded. The detachments and horses suffered so severely that the guns could scarcely be served or moved, and the teams were in some cases reduced to two.

But the sacrifice was not in vain. The infantry was terribly cut up, but was saved from complete annihilation, and when they were in comparative safety the guns attempted to withdraw. The 2nd light battery, which had remained to the south-east of Mars-la-Tour, covered the movement with its fire, but it was only with the greatest difficulty that the guns could be removed. Indeed, but for the devotion and bravery of the cavalry neither guns nor infantry could have made good their retreat.

For seeing the danger of the situation the 1st Dragoons of the Guard charged the leading French regiment with headlong courage and rescued the 57th Regiment and the battery which had last waited. The two squadrons of the 4th Cuirassiers, which formed the escort of the Corps Artillery, also made a gallant charge and extricated another battery, and then the six batteries fell back to a position south of the road to Vionville, from which vantage ground their fire was so

effective that the pursuit of the disorganised infantry was abandoned, and the cavalry were able to reform behind the line of guns after their brilliant charge. Shortly after this a strong French cavalry force appeared on the ridge above Ville sur Yron in four compact masses, which were charged by General von Barby, and the greatest cavalry combat of the war, when 5,000 mounted men met in hand-to-hand encounter, took place. After a stubborn contest the German horsemen forced their opponents back, and the French right wing then gave up any further attempts to act on the offensive.

Darkness was now approaching, and the Germans stood where the French had been in the morning, but though they continued to make inroads on the French position, it was rather with a view of deceiving their foes as to the force opposed to them than with any idea of gaining any larger success.

Von Alvensleben had accomplished, perhaps, the most brilliant achievement of the war in keeping up the fight till the afternoon with his single corps, and driving the enemy from Flavigny to Rezonville, a half-mile to the rear. "Thanks to the valuable assistance of the 10th Corps, the battle could be carried on through the afternoon on the defensive, but only by most decided counter-attacks from the cavalry, and the unflinching tenacity of the artillery." [1]

During the night the enemy evacuated the positions he still held, and abandoning the march to the west withdrew nearer to Metz. The object of the Germans was gained.

During the day 138,000 French, with 476 guns, had engaged 67,000 Germans, with 222 guns. The losses of the latter amounted to 660 officers and 15,170 men, those of the former to 859 officers and 16,128 men. [2]

The artillery losses were very heavy in some cases. The heaviest were as follows :—

Battery.	Killed.			Wounded.			Remarks.
	Officers.	Men.	Horses.	Officers.	Men.	Horses.	
1st Heavy Field Battery, 3rd Corps...	—	9	40	1	31	—	
2nd " " " " ...	1	8	40	2	37	—	
1st Light " " " " ...	—	3	40	3	30	—	
2nd " " " " ...	2	4	42	2*	39	8	* Including the doctor.
6th " " " " ...	—	3	29	1	17	15	
3rd " " " " ...	—	5	25	2	15	15	
*a*1st Horse Artillery " " ...	—	3	42	3	18	17	
*b*2nd " " " " ...	—	5	23	—	14	18	
3rd " " " " ...	—	4	50	4†	26	28	†1 mortally.
*c*1st " " " 10th Corps .	—	4	18	3	38	17	
2nd " " " " ...	—	6	47	—	15	3	
3rd " " " " ...	—	3	24	1	19	25	
1st " " " 4th Corps...	1	3	21	1	18	15	

a Fired 1148 shells. *b* Fired 1164 shells. *c* Fired 1048 shells.

[1] Von Moltke.

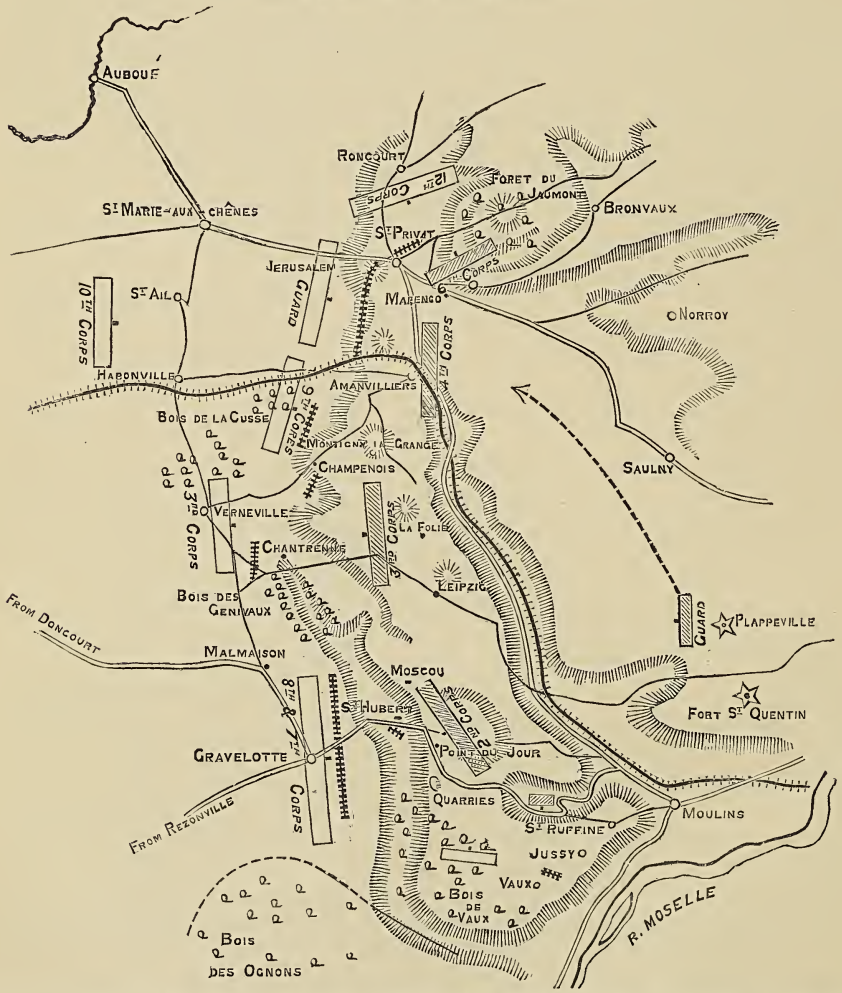
[2] Hoffbauer.

Including the lines of wagons, which were in rear and as far as possible under cover, the strengths were as follows :—

	Officers.	Men.	Horses.
Horse Artillery Battery	4	150	207
Light Field ,, ...	4	145	124
Heavy ,, ,, ...	4	151	126

At the battle of Gravelotte on the 18th of August, to which that of Vionville led up, the German artillery certainly played a most prominent part, even if it cannot claim quite so predominant a share in the results of the day as in the fight just spoken of. More than 500 guns were standing in action when night closed in, divided broadly into three great masses. On the right of the German line of battle

BATTLE OF GRAVELOTTE.—18th August, 1870.
(At the end of the Engagement).



round Gravelotte, were placed astride the high road, including one at

St. Hubert and one south of Jussy, 31 batteries, firing on the French position from Moscou to Point du Jour and the Quarries. At the centre, east of Verneville, were posted 17, divided into three nearly equal portions, firing on the French centre at Amanvilliers, Montigny, and La Folie, while the attack of the left wing on St. Privat and the French right was supported by the fire of a mass which at the end of the battle numbered 38.

At the commencement of the action the guns of the 9th Corps had surprised the French camp at Montigny la Grange, just as artillery had surprised the bivouacs two days previously at Vionville, and, supposing the enemy's right only to be in front of them, had come into action with the single-minded desire to engage the enemy, which was characteristic of all the German Corps Commanders during the war, and had suffered heavily in doing so. A storm of shell, mitraille and rifle bullets soon burst on them from the strongly posted masses in front, and, although the artillery nobly held their ground, and compelled several of the enemy's batteries to withdraw, the concentrated fire on their flanks, front, and even rear, was overwhelming. The 4th heavy Field Battery, commanded by Captain Werner, lost, in less than half-an-hour, three officers and three-fourths of the men, while all the horses except eight were either killed or wounded.[1] Four of these guns could in fact only be got out of action by the most strenuous exertions of its officers, and two had to be abandoned. Success was, indeed, out of the question for these heroes, who were thus boldly attacking a powerful enemy that showered them at comparatively close quarters with both artillery and musketry fire. After heavy losses the squadrons, which formed the only escort of the batteries, retired, but the guns still strove against the inevitable. By two o'clock, however, all the batteries here were almost *hors de combat*, and those of the Corps Artillery of the 9th Corps had to be withdrawn in order that they might gain breathing time and refit.

The Hessian Division now, however, arrived, their five batteries were sent to the support, and the Corps Artillery of the 3rd Corps and some of the Artillery of the Guard also was called up to the rescue. The remaining batteries of the 9th Corps were thus enabled also to retire out of the fight and make good the heavy losses they had sustained.

The fine example they had set was of immense value, and although they suffered so severely, the effect they had produced might console them for the sacrifice. The great losses were chiefly due to the fire of the French sharpshooters, who, concealed by cover, were able to approach with comparative impunity, and the batteries, moreover, had to contend with them almost alone, for they were but very inadequately supported by their infantry, who found it impossible to make way against the enemy's fire in time to aid their comrades. However, the arrival of the Corps Artillery of the 3rd Corps under Von Dresky, whose exploits we had to notice in the preceding battle, went far to restore the balance. It pressed forward on the left of the guns already in

[1] Hoffbauer.

action, and by 4 o'clock the effect of the concentrated fire delivered by this mass of guns was so great that battery after battery on the heights opposite were silenced, and all efforts of the enemy to bring fresh guns into action were frustrated.

As soon as the hostile artillery was silenced, the guns set themselves to drive the enemy out of Champenois, and the batteries which had retired to refit now came into line again and co-operated.[1]

The artillery claim that Champenois was evacuated owing to the concentrated fire these guns were able to pour upon it, and certainly the effect of their shells was so great that the enemy were foiled in all their efforts to place fresh guns in position against them. The French account given by General Frossard says :—"The artillery of Montaudon's, Grenier's and de Cissey's divisions, fired on by numerous batteries, suffered severely."

Their fire had, in fact, enabled the 9th Corps to press forward like a wedge towards the enemy's main position, and to establish itself there so securely as to defy his efforts to dislodge it.

About 5 o'clock, after the farm of Champenois was taken, fatigue overpowered both combatants at this part of the field; further advance on the German side was hopeless; the musketry ceased entirely; and by degrees the guns, too, became almost all silent.

It had not been intended that the 1st Army should assault the French position in earnest until the 2nd Army stood close to the enemy; but when the brisk firing was heard from Verneville, the artillery, both of the 7th and 8th Corps, was sent forward to prepare the way for the infantry. The movements of the batteries of both corps are so closely connected that they may be dealt with in the same account. Sixteen batteries were sent at first into action, very soon their number was increased to 20, and ultimately as many as 168 guns were unlimbered, and cannonaded the enemy's position from Moscou Farm to the Quarries south of Point du Jour. They were placed on the ridge east of Gravelotte, astride the high road.

The effect of the German artillery was proved by the gradual disappearance of the French batteries opposed to them, and the explosion of several of their limbers and ammunition wagons. Indeed, the French have admitted that the fire of this great mass of artillery was overwhelming, and that it silenced their guns and set Moscou and Point du Jour in flames. The conformation of the ground here interfered, however, to some extent with the co-operation which the guns could lend to their comrades of the infantry. The deep ravine in front of them rendered difficult the advance of the batteries, and consequently the infantry could not be so completely supported when they crossed this hollow and advanced to the attack beyond as they might otherwise have been. Moreover, the French riflemen were mostly under cover, and the task of dislodging them from the buildings they occupied was no easy one, when the advance of the infantry masked the fire of the guns.

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[1] One was lucky enough to find ten cast horses in an adjacent farm, which were at once made use of.

At four o'clock, General Steinmetz determined to make a renewed attack. Four German batteries, supported by the 1st Cavalry Division, hazarded their own safety in an attempt to cross the ravine opposite St. Hubert. As soon, however, as the long column came in sight, the French redoubled their fire both from guns and rifles. One of these brave batteries soon lost the detachments of four of its guns, and was with difficulty withdrawn ; a second never succeeded in getting into position at all, but two, those of Captains Hasse and Gnügge, held their ground in spite of the loss of 75 horses and the fire which assailed them, both from their front and the Quarries in their rear.

But the infantry attack had not sufficiently progressed at this time, and the thrusting forward of cavalry and artillery was premature. The leading regiment of cavalry attempted to advance against Point du Jour, but the enemy were under cover and soon compelled it and the remainder of the division which followed it to beat a hasty retreat.

Encouraged by their success the French in their turn now took the offensive and advanced from Point du Jour in swarms of skirmishers, whose fire forced the Prussians off the open ground and compelled them to seek the shelter of the wood.

St. Hubert, however, which had been captured earlier, still remained in the hands of the Germans, and the fire of its garrison and the much maimed battery which supported it was so deadly that the French were unable to cross the open ground which the post commanded, and their counter efforts, therefore, could make no headway. The fire of the great artillery mass formed by the guns of the 1st Army had also meanwhile continued the contest whenever its fire was not masked by the advance of its own troops, and its effect was such that, although the German efforts against Point du Jour and Moscou were unavailing, the French could not drive back across the ravine the comparatively weak detachments which held their ground beyond it. About 5 o'clock hostilities ceased in this part of the field also. Both sides were sore and weary and were glad of breathing time, so, as if by mutual consent, the firing gradually died away.

Although the general account of the fighting at this extremity of the battle-field may thus briefly be dismissed in paragraphs such as these, it is due to the batteries led by Hasse and Gnügge to dwell longer on performances which will be remembered amongst the most splendid of artillery achievements, as far at least as the pluck displayed by them is concerned. Captain Hasse's Horse Artillery Battery, on emerging from the ravine in the attack which General Steinmetz ordered at 4 o'clock, wheeled to his right, and came into action on the left of the battery commanded by Captain Trautman which preceded it. Captain Gnügge, not finding sufficient space beside the others, got into position rather in front of them. The enemy's skirmishers from Point du Jour, Moscou, and the Quarries poured such a fire on the front, rear, and flanks of the three batteries, which thus succeeded in getting into position on the east of the ravine, that their situation soon became desperate. Trautman's battery had just succeeded in opening an effective fire on Moscou, distant about 1000 paces, when the teams of four limbers, most of the horses being wounded, bolted down the defile

and could not be stopped, even by the most energetic efforts on the part of the officers. A single limber was with difficulty brought back to the guns, where "the only men fit for duty besides the officers were a non-commissioned officer, a driver, and two gunners."[1] Two guns were brought away with difficulty, but the remaining three (one had been abandoned in the defile when moving into position) had to be left where they were, and were not brought off till after dark.

Hasse's battery from the first sustained enormous losses. Two other officers were severely, and Captain Hasse himself was slightly wounded. All the officers' horses were shot. But in spite of the sacrifices it had to make the battery held its ground, and maintained its fire with great effect.

Seeing the precarious situation in which it was placed Lieut.-General von Schwartz sent his Adjutant to tell it to withdraw.[2] So many horses had been killed, however, that it would have been impossible to move the guns, and the gallant Hasse said he preferred death to leaving them. They continued, therefore, to fire until only one gun could be worked, and that only by four men. The detachments of all the others were either killed on wounded. The ammunition in the limbers and in the remaining limber of the wreck of a battery along side them was exhausted, and the ammunition wagons had not been able to pass the defile. Such was the situation when Major Coester reached the scene with three wagon teams and orders from General von Schwartz to bring back the disabled battery.

The limbers riddled with bullets and guns laden with wounded were at length brought away through the defile—a few drivers on foot leading the two or four horses which dragged them painfully along.[3] Major Coester's horse was then shot under him, and the last gun, reduced to one horse and piled with wounded, had to halt and wait for further assistance.

At length Gravelotte was reached. The return of the heroic battery was greeted with loud cheers all along the line, while Von Schwartz embraced its commander with emotion in the presence of the troops.

Its retreat[4] "was a triumphal march in the real sense of the word."

For two hours this battery had stood its ground in an exposed position within a few hundred paces of the enemy's skirmishers, "yet it was not until after repeated solicitations by his superior officers that Captain Hasse abandoned the position." This battery had 3 officers, 30 men, and 10 horses wounded, and 5 men and 67 horses killed.

Captain Gnügge was now left alone in the advanced position he had occupied. His guns were slightly protected by a low garden wall, but he also experienced heavy losses from the first. He kept up an effective fire, however, at 800 to 1000 paces on Moscou, which was set on fire by his fire and Hasse's, while the fresh batteries which the enemy tried to bring up were invariably prevented from coming into action.

But this gallant battery distinguished itself most especially at the

[1] Hoffbauer's account.

[2] Hoffbauer's account.

[3] Official account. Part I., Vol. II.

[4] Hoffbauer.

close of the day, when the 1st Army was again ordered to assume the offensive, supported by the 2nd Corps which was arriving on the battle-field. Von Moltke with admirable candour has blamed himself for ordering this movement,[1] which could hardly be expected to lead to any decisive issue at so late an hour, and wasted many valuable lives for a very minor result. As the German advance began the French re-opened fire with unexpected vigour, and their reserves were brought up as though they too meditated offensive action. Swarms of skirmishers issued from Point du Jour and Moscou, and the German troops in front were pressed back in something like a panic. The garrison of St. Hubert, however, stood firm, and Gnügge's battery, realising the gravity of the situation, staunchly held its ground too. This is how Hoffbauer tells the story :—

"Even when the mass of stragglers rushed towards the battery Captain Gnügge preserved an unshaken calmness, and endeavoured to restore order out of chaos. Vain attempt! The mighty stream could not be checked but poured through the battery, where it was overwhelmed by the enemy's fire, and men and horses were crushed together. Everything was obscured by clouds of dust. Captain Gnügge, utterly powerless, saw part of his battery swept away in the general confusion, and when the turmoil was over three guns without limbers and another unhorsed limber was all that remained in its original position. Collecting, however, a few gunners and infantrymen, about 30 in number, he opened fire on the pursuing skirmishers and repulsed them.

The German infantry then again advanced in good order against the enemy's position, so that the battery was unable to fire more than a few rounds in the direction of Point du Jour for fear of hitting some of the troops. Second Lieutenant Wintgens had meanwhile removed his division of the battery to a position 200 paces to the rear near the high road to support the infantry. There he had time to fire a few rounds of shell and case in the direction of Point du Jour before the guns were masked by the advancing infantry. The battery did not quit the position where it behaved so nobly until darkness made it impossible to lay the guns, and the 2nd Corps advanced to the assault."

What will strike the reader of these stirring incidents is the almost reckless manner in which the German artillery, in the same spirit as prompted Nelson's Captains to lay themselves alongside of their enemy, did not hesitate to seek close quarters when it was desired to produce a decisive effect, and the chief testimony to their effect is to be gathered from the official account which, reviewing their performances with judicial calmness, considers the lavish sacrifice of men and horses justified by the results achieved.

Of Gnügge's battery it is written that it held out, "although it is true the musketry and mitrailleuse bullets showered unceasingly on its exposed right flank, and even on its rear, occasioning heavy losses. But, on the other hand, at this most advanced post of the Prussian infantry, Captain Gnügge found himself within such close range of his

[1] "It would have been better if the chief of the Staff, who was personally on the field at the time, had not allowed this movement at so late an hour." The Franco-German War, by Von Moltke. Vol. I., p. 78.

marks that he was able to produce *the greatest effect* upon them. He repeatedly scared away the French batteries, which attempted to take up a position near the burning Moscou, and the infantry which strove to advance from thence."

That guns firing only common shell should be able to effect so much from ground within a few hundred paces of hostile infantry firing on them with the Chassepôt, which was capable of effective aimed fire at 1500 yards, says much in favour of the gunner's claim that his arm is capable of something considerably more than the merely moral effect with which only it is occasionally accredited. Nor must it be forgotten that they thus faced an almost impregnable position, not borne onward in the rush of a pronounced success, but rather to avert disaster during the long drawn stress of a doubtful fight. Captain Gnügge's battery lost 2 men and 26 horses killed, and 1 officer, 12 men, and 14 horses wounded.

While the battle was thus indecisively dying away on the German right and centre, and the guns were straining every effort to avert defeat, greater issues were being attained far away on their extreme left.[1]

At two o'clock the Artillery of the Guard and 3rd Corps had been sent to the support of that of the 9th, and between Verneville and St. Ail 130 guns were soon in action, and destroyed any chance the French ever possessed of here making an effective counter-stroke. The main body of the Guard was at this hour at St. Ail, and General von Pape, recognising that the French line was prolonged further than had been imagined, saw the necessity of capturing St. Marie-aux-Chênes ere any further progress could he hoped for. But before attempting to do this he must wait for the arrival of the Saxon contingent. The Guards had sent away most of their guns to support the 9th Corps, so the assistance they received when the Saxon batteries came into action west of St. Marie about three o'clock was most welcome. Then ten batteries opened on the village, and in half-an-hour it was carried by assault, while, as we have seen, Champenois was captured by the 9th Corps soon afterwards. Then the fight remained stationary till between 5.30 and 6 o'clock, when the celebrated attack of the Guards on the strong French position at St. Privat was impatiently launched before the German batteries had thoroughly prepared the way for it.

Prince Kraft says that the artillery did not know that this assault was intended, and were first apprised of the fact by the advancing infantry masking their fire, or they would have forced a way for the infantry in this case as successfully as they had previously done at St. Marie.

As it was, if the infantry did not wait for them they did not wait for the infantry, but hurried on with the assault to the very closest quarters, till twelve batteries of the Guard were soon standing with the firing line in the very thick of the fight.

The Hessian batteries in front of Amanvilliers supported this forward movement, and eventually some of them came into action on the right

[1] General Sheridan, who was a spectator at this portion of the battle-field when he saw the panic just described, was of opinion that the Germans would lose the day.

of the Artillery of the Guard. The infantry pressing forward interfered with the action of the batteries to some extent, and the guns were sent to the front again so as to be able to co-operate more effectively with the sister arm. Six batteries forming the right wing of the artillery line galloped ahead, therefore, and reached the high ground south of St. Privat almost simultaneously with their own skirmishers. The left wing, reinforced by two Horse batteries of the 10th Corps, similarly pressed forward, joined the infantry firing line, and turned their guns on the walls of the village. The effect of this fire was so murderous that some French officers who were taken prisoners assured Prince Kraft, who commanded the Artillery of the Guard, that had the assault been delayed for half-an-hour no defenders would have been found remaining in the village.

But that movement was now fairly under way and had to be persevered in although men were falling rapidly, and the advance up the slope in the teeth of a remorseless fire from a foe under cover resembled a forlorn hope. Eventually, however, the heights were gained, but the danger was by no means over yet, for Cissey's Division advanced to dislodge the victors, and, weakened and tired as they were, it was all the Guards could do to hold the ground they had won so dearly. The enemy's fire from St. Privat and Amanvilliers also swept their ranks, and the situation was, in fact, most precarious. Anxious eyes were looking back for the advancing artillery, and the cry for support was responded with ready goodwill by the nearest guns.[1]

Captain von Prittwitz had noted the danger, and without waiting for orders led his battery (the 2nd heavy battery of the Guard) up the slope, and coming into action along side the hard-pressed infantry its fire maintained the safety of the important point which they had captured against all the attacks that were directed on it. And the battery paid dearly for its temerity. Heavy losses were experienced from the hostile musketry fire, and Lieutenant von Winterfeld was severely wounded, while in the advance three guns had to be left behind, "one of them having lost all its drivers."[2] Nor was this battery alone in gallantry. With equally splendid courage did the 3rd light battery of the Guard Corps Artillery also press forward, and, in spite of severe loss and the death of its Captain, made its weight felt. These two were followed by Captain Seeger, and all directed a most deliberate and effective fire on the enemy, who advanced against them from Amanvilliers. Prince Kraft tells the story thus :—

"The battery[3] galloped up the slope of the hill and joined the skirmishers as they moved to the assault ; only three guns at first reached the top, the three others having lost horses as they advanced. At the spot where the battery came up, the crest of the hill is so wide that it almost amounts to a plateau. The enemy's skirmishers were flying before ours. But at a distance of from 300 to 500 paces in front of us, masses of the enemy in quarter columns, were advancing to dis-

[1] Official account, Part I., Vol. III.

[2] Hoffbauer's account.

[3] That of Von Prittwitz.

pute the crest of the hill with our skirmishers. You can scarcely imagine the effect which the first shot of Prittwitz's produced on these masses. In an instant they became motionless as if they had received a violent electric shock. But when shell after shell began to burst in the middle of them, when our line of artillery was reinforced by my other batteries as they arrived in turn at a gallop, and by the three guns of the first battery which succeeded in rejoining us, the columns at once took to flight. Then my 30 guns set to work to find the range by giving trial shots at different points, while on our left the fire was raging round St. Privat. The possession of our height was of the greatest importance. From it to our right we could enfilade Amanvilliers, for we could see its steeple above a slight undulation in the ground. . . . ."

A second attack by the French was repulsed with equal success. It had advanced in quarter column from Amanvilliers.

"When the head of the column became visible over the hill, our trial shots reached it at a range of 1900 paces, and my 30 guns opened a rapid fire. The enemy's infantry was enveloped in the thick smoke which the shells made as they burst. But after a very short time we saw the red trousers of the masses which were approaching us appear through the cloud. I stopped the fire. A trial shot was fired at 1700 yards range; this was to show us the point up to which we should let them advance before re-opening the rapid fire; we did the same for the ranges of 1500, 1300, 1100, and 900 paces. In spite of the horrible devastation which the shells caused in their ranks these brave troops continued to advance. But at 900 paces our fire was too deadly for them; they turned short round and fled; we hurled shells after them as long as we could see them. *Here was an infantry attack which was repulsed purely and simply by the fire of artillery.* A few years later I had the opportunity of talking with an aide-de-camp of General de Ladmirault, the very man who had carried the order to make this counter-attack, and who had been present during its execution. Two regiments of infantry had been despatched on this duty. The French officer said to me, "It was impossible to succeed. You have no idea what it is to advance under the fire of your artillery."

Thus was a force equal to six battalions of our regiments defeated by guns firing common shell, a projectile so little effective as compared with modern shrapnel that in future it will only be carried by batteries for ranging purposes.

The fire of these guns, combined with the musketry of the weak infantry force with them, continued so deadly that all the attacks of the enemy broke down, and the fight gradually passed from the critical stage into a stationary action.

At 6.15 the attack on St. Privat had come to a stand-still, and the 12 batteries of the Guard, with the two Horse Artillery Batteries of the 10th Corps, continued to support their infantry in the positions they had gained. At 7 o'clock these 14 batteries were divided into two groups, of which the first was directing its fire on St. Privat and Jerusalem, whilst the other was fronting towards Amanvilliers. The combined efforts of the first group soon made itself felt in a very

forcible manner. Jerusalem was quickly set on fire, and even in St. Privat itself the flames rose aloft in several places. "Already under the iron hail the enemy's masses were gradually thronging more closely together, while the bulwark of the French position was every minute more surely gripped from the north."[1] For the 12th Corps was now deploying its guns between Roncourt and St. Privat, and 11 batteries lost no time in cannonading the former village and the French right wing, whose fire was soon almost reduced to silence.

The French, thus pressed by the Saxons on one side and the Guards on the other, were compelled to withdraw from Roncourt, and the Crown Prince[2] sent further forward the artillery of his corps to envelop St. Privat from the north-west. Fourteen batteries, formed in one great line, were placed, therefore, in position with their left resting close to Roncourt, and firing on St. Privat effectively supported the advance of the Saxon battalions. Thus at this time 24 batteries were overwhelming the devoted village with a perfect storm of missiles.

"Walls and building crumbled under the crash of the shells, and the columns of fire rose in several places above the ruins of the village."[3] The moment for the decisive blow was, indeed, ripe. The drums and bugles sounded the charge, and the Saxons from the north-west, and the Guards from the south, rushed with exultation on the stronghold, which had cost them so much earlier in the day, but now lay helpless within their grasp. At 8 p.m. it was definitely in German hands, and the defeat of the French right wing was assured.

But the roar of battle, still for a moment when the village had been captured, broke out soon in another outburst which lasted till nightfall, when the guns of the French Guard came into action near the Amanvilliers Quarries along the edge of the forest, and cannonaded the batteries of the German Guard. They, however, had now been reinforced by the guns of the 10th Corps and the Hessian Division, and as darkness closed the roar of cannon died away, and the French guns were withdrawn.

It was at this stage of the fight that, according to the official account, the 5th and 6th light batteries of the 10th Corps specially distinguished themselves by advancing to the knoll on the east of St. Privat so as to engage the French artillery at a more effective range. Scarcely had they driven up when the first-mentioned battery found itself assailed in flank by hostile infantry, which it turned on in a moment and drove away. A similar result attended all the other sallies of the enemy, who were obliged to retire with heavy losses.

The same spirit animated the batteries on the German left, and when St. Privat fell the masses of guns were again sent forward to secure what had been won, and thus at the close of the day an almost continuous girdle of 38 batteries or 228 guns, extending from the Forêt de Jaumont by St. Privat to the Bois de la Cusse, was fastened round the French right wing.

During the night the French evacuated their positions, and withdrew

[1] Official account, Part I., Vol. II.

[2] Of Saxony.

[3] Official account.

to Metz. 178,818 Germans had succeeded in driving 180,000 French out of a position of almost unrivalled natural advantages. During the battle the artillery had vied with its sister arm in heroism, and assuredly could lay claim to a most important share in the glories of a victory which, decisive in itself, was yet but the culminating point of the success achieved two days earlier mainly by its bold and enterprising behaviour.

Nor were the services of the German guns unrecognised in the official account which, deliberately reviewing the incidents of the fight, kindles for a moment to eulogise the manner in which they were employed, "at first in masses, and afterwards in the most intimate connection with the task of the infantry."

(*To be Continued.*)

APR 1 1893
U.S. PATENT OFFICE

THE SUDAN PAST AND PRESENT.

BY

MAJOR F. R. WINGATE, *D.S.O.*, R.A.

THE writer greatly regrets that circumstances prevented him from fulfilling his engagement to read a paper on this subject at the Royal Artillery Institution, and begs to acknowledge the kindness of Messrs. Macmillan & Co., and Messrs. Sampson, Low, Marston & Co., in permitting the reproduction of the Map of Egypt and the Plan of Omdurman, for the purpose of illustrating this article.

IN a paper contributed to the recent Congress of Orientalists, I dealt with "the rise and wane of the Mahdi religion in the Sudan," and throughout I endeavoured to treat with the great revolt in the Sudan, as far as possible, from its religious aspect. In the following pages, however, I propose to deal with the same subject from a military point of view, and in so doing I will presume that my readers are generally cognisant of the religous side of this gigantic revolt against Egyptian authority and the orthodox Moslem faith. I do not, therefore, intend to repeat here—except where it is necessary to do so for a correct understanding of the subject—the curious condition of Islamism in the Sudan which allowed of the creation of a situation warranting the appearance of a Mahdi; suffice it to say it should always be remembered that in the various military operations which took place, the wildest religious fanaticism existed. It is the existence of this element which gives such a lurid glow to all those dark episodes of Sudan history with which the past ten years have been replete. Without fanaticism the revolt could never have been successful, while with it, one is brought face to face with a condition of warfare and religious enthusiasm to which one must go back to mediæval history and to the crusading times to find a parallel.

In assuming, therefore, that the religious aspect is understood, the subject is, perhaps, shorn of some of its most interesting features, and standing thus alone in its military aspect this paper cannot pretend to be in any degree a complete *resumé* of the history of "The Sudan Past and Present." All it can aspire to is a brief and incomplete summary of military events in the Sudan and of the various operations which have, from time to time, been undertaken to check the progress of a revolt, which at one period seriously threatened to disturb the peace not only of the Sudan and Egypt, but also of a large portion

of Northern, Eastern, and Central Africa. I will also add a few remarks on the existing situation, concluding with a brief sketch of the military power and organisation of the forces of the present ruler, and a description of his capital of Omdurman, which has taken the place of Khartum—now merely a heap of mud ruins over which a mass of prickly thorn bushes have sprung up, and which, in Father Ohrwalder's words, "cover as with a veil the sad remnants of the once thriving and populous metropolis of the Sudan."

A word here regarding Joseph Ohrwalder, whose observations I have just quoted. It will, doubtless, be remembered that he, with several other members of the Austrian Mission, were among the first to fall into the hands of the Mahdi, in whose camp he, for upwards of ten years, endured the most appalling hardships, and from which he only recently escaped after a series of hair-breadth escapes. The account of his life, which it has been my pleasing occupation to render into English, is now, as I write, on the point of publication.[1]

Father Ohrwalder has thrown a flood of light on many dark episodes which hitherto have never been fully explained, and in the following remarks I have made a generalised use of the information which has been supplied by him and which, therefore, bears the additional impress of unquestionable accuracy.

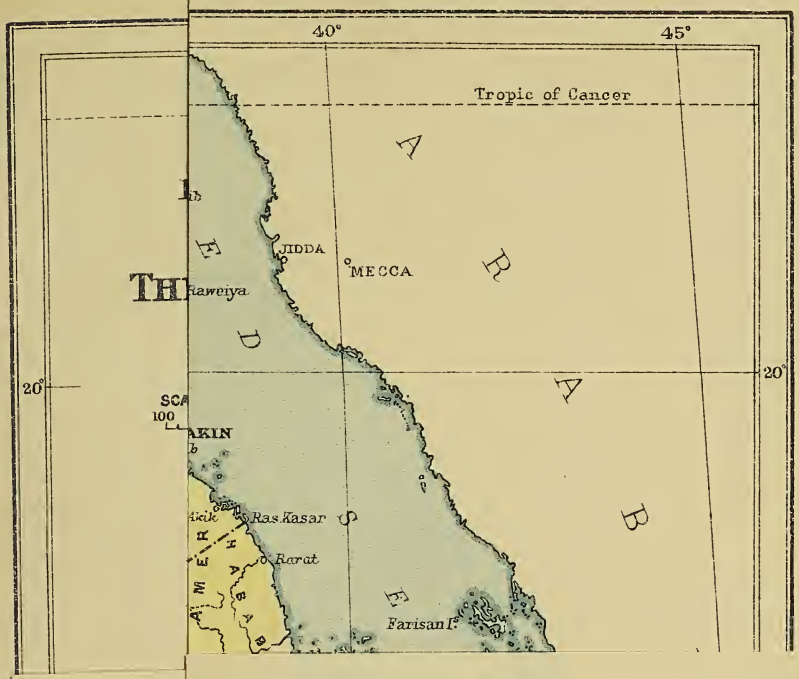
There is yet one other point which, at the risk of tedious repetition, must be here inserted. I refer to the ethnographical sub-division of the Sudan, a brief summary of which is absolutely essential to a correct understanding of the military aspect of the revolt.

For present purposes we may consider the Sudan as divided into five main classes. (*See* Map.) It will be observed that the 13th parallel of latitude forms the division between efficient rain and scanty rain; between cattle Arabs and camel Arabs. South of this parallel camels are not usually bred, while north of it cattle are not found. To the north of this parallel dwell the great camel-owning tribes, such as the Kababish, Ababdeh, Shukrieh, and Hadendoa, whose instincts are naturally peaceful because their property brings them profit in proportion as it is employed in the transport of goods. These Arabs may be designated the first class.

The second class comprise the negroid tribes, who live in Darfur and in the mountainous country to the south of Kordofan; these races no doubt formed one of the ancient kingdoms which stretch across Africa, and may be numbered from the west as follows:—Senegambia, Bambara, Massina, Gando, Sokoto, Bornu, Bagirmi, Wadai, Darfur, Sennar, and Abyssinia; they are a contented and domestic race who have little in common with the Arabs, and with whom they are constantly at war.

The third class are the dwellers in towns and villages; these are a mixture of almost every Eastern race; by intermarriage with Bashi-Bazuks, Egyptians, and the foreign traders, they form a population which may not inaptly be compared to that of a Levantine seaport—idle, dissolute, drunken, demoralised, they are superstitious to the

[1] "Ten Years' Captivity in the Mahdi's Camp."—Messrs. Sampson, Marston, Low and Co., Limited. London, 1892.


40°
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Tropic of Cancer
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20°
JIDDA
MECCA
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Farisan I.
A R A B I A N S E A

ETHNOGRAPHICAL
OUTLINE MAP OF
THE EGYPTIAN SUDAN
1891.
SCALE, 1:2,222,666 OR ABOUT 180 MILES TO 1 INCH.
CONVENTIONAL SIGNS
Caravan Roads
Stream Beds
Rivers
Villages
Boundary defined by British and Italian agreement. 1891.
Southern Limit at which Camels are bred
Coincides with S. limit of Camel Arabs
approx. S. limit of Adansonia (Baobab trees)
CAMEL ARABS
CATTLE ARABS
CATTLE OWNING NEGROIDS
CATTLE OWNING NILOTIC NEGROIDS
IRON WORKING NEGROIDS
THE GREAT FOREST
Longitude East 30° from Greenwich
Stanford's Geogl Estabt London.
London: Macmillan & Co.

lowest degree. Such is the population at Berber, Khartum, Sennar, and most of the large towns, while the centre of the plains of Kordofan contains a nucleus of 800 or 900 villages, which excel all others in baseness; these villages contain a population of about 130,000, probably the most worthless in the world.

They are over-ridden by a most shameless set of fikis or religious teachers, who are supposed to be invulnerable, supernaturally endowed, and able to work miracles. It can readily be imagined what an important factor were these fikis in the Mahdi revolt.

The fourth class may be designated as the great slave dealers of the Sudan; these people inhabit the country below the 13th parallel, to the west of the White Nile; here cattle replace camels, and to the south of Kordofan, and stretching away to the south-west and north-east are the tribes and innumerable sub-tribes of the Baggara, the Red Indian of the Sudan; their geographical position places them in touch with the great negro supply to the south and the great retail market of Khartum to the north, and these are the great slave-forwarding agents of the world; they are inured to war and in constant readiness to plunder.

Below the Baggara come the great cattle-owning negroes and negroids, who, like the second class, are a peacefully inclined people, and who for years have supplied the Khartum slave market. Indeed, whole tribes have been deported. Being heathen there is no one idea which appeals to the large masses of them. It was from this class that Zubeir Pasha and his son, Suleiman, raised armies; it was with these men that Sir Samuel Baker and General Gordon performed such prodigies; these are the men who form the nucleus of the army of the present ruler of the Sudan; they are the races who supply the Egyptian Army with its black battalions, who have again and again proved their sterling fighting qualities, and these again are the men who will have to decide the struggle which will ensue when an advance is made on the Sudan. The value of this class of the population can hardly be over-estimated, and the European nation which sooner or later extends its sphere of influence over these distant lands will secure a recruiting ground for troops to whom for reckless bravery and endurance it would be hard to find an equal. This is a point worth bearing in mind by extensively colonising European nations desirous of obtaining auxiliaries who are less tied down by feelings of patriotism than perhaps any other class, and who have been truthfully described as creatures who "eat, drink, and fight, but never pray."

With the above introductory remarks, the ground has been somewhat cleared, and now we may proceed to a consideration of some of the military bearings of the Sudan revolt.

General Gordon described the Sudan as "larger than France, Germany, and Spain together," and it is as well to bear this fact constantly in mind in order to understand how entirely distinct were the various military operations which took place all over this vast extent of country; but, distinct as they undoubtedly were, yet each separate centre of revolt largely depended on the success or failure of movements carried out in other parts of the country hundreds of miles distant.

The early history of this vast country is but imperfectly known. Roman sway did not extend below the second cataract, and it was not till 1820 that any attempt was made to subjugate this hitherto almost unexplored land. In this year the forces of Mohammed Ali reached Khartum, whence they divided up the Blue and White Niles. The town of Sennar which had formerly been renowned as a seat of learning, was captured by Ismail Pasha, who, on his return journey in 1822, was treacherously burned at Shendi.

The Egyptian authority was, however, gradually established, and sixteen years later the Sudan was visited by Mohammed Ali.

A local revolt occurred in 1841, which was without much difficulty suppressed, and other large tracts of country annexed.

Said Pasha has the credit of having attempted to establish a more orderly and beneficient form of government, but in 1865 a further revolt of the negro troops of the Khedive in the province of Taka brought about a renewal of the repressive measures, which bore bitter fruit later on.

Meanwhile various geographical expeditions had greatly extended the knowledge of this dark country. A recollection of the memorable events connected with Burton and Speke's journey to Uganda has been recently revived by the stirring occurrences which have just taken place within the territory of the Imperial British East Africa Company; while Sir Samuel Baker's wonderful exploits, adventures, and discoveries in the regions of the White Nile to Albert Nyanza, have been over and over again referred to in the numerous works which the strange circumstances connected with Emin Pasha and his deliverance have given to the world.

The annexation of these provinces was brought about by Ismail Pasha, pressed by the Powers, and especially by England, to suppress the slave trade. It was under his instructions that Sir Samuel Baker annexed Gondokoro and established Egyptian military posts almost as far south as the Equator, whilst other expeditions penetrated into the Bahr el Ghazal on the one side, and as far as Senheit in Abyssinia on the other. Sir Samuel Baker was in 1874 followed by General Gordon, who in 1877 became Governor-General of the Sudan. It was during this period of Gordon's residence in the Sudan that an event occurred which, though forgotten at the time, has quite recently become involved with some interest, and which may still have a more important bearing in the future.

I refer to the suppression of Suleiman Zubeir's revolt in the Bahr el Ghazal at the hands of Gessi Pasha. It will be remembered that Gessi succeeded in breaking up this revolt and in executing Suleiman and eleven of his chiefs; but a large portion of Suleiman's army succeeded in escaping with their arms and ammunition, and were entirely lost sight of in the stormy events occasioned by the Mahdi's revolt. But all this time the leader of the vanished portion of Suleiman's army—known as Rabeh Zubeir—was not inactive; it has only recently transpired that he quitted the Bahr el Ghazal, took up a position on the south-east confines of Wadai, and after incessant wars with the forces of that country, during which he made himself master

of a considerable portion of territory and largely increased his army, he moved further west and established himself on the banks of the Sharé River, which flows to Lake Chad. Here he became master of a large portion of the country to the south and east of Bagirmi.

The present ruler of the Sudan has made frequent attempts to secure the alliance of this quondam Egyptian subject, but the latter has remained firm, and now the most recent intelligence points to the western dominions of the Khalifa of the Sudan being threatened by the advance of Rabeh and his followers, who represent a force of well-armed fighting blacks, which may well occasion Abdullah et Taishi some uneasiness.

But to revert. Gordon returned to Cairo in 1879, and was succeeded by Rauf Pasha, whom he had thrice dismissed for misrule and oppression.

As far as it is possible to estimate from imperfect records, the Sudan garrison were, in 1881, distributed as follows :—

Berber	2170
Khartum	7470
Kordofan	5830
Sennar	2350
Karsala	3940
Dongola	950
Amadib	920
Galabat	1610
Senheit	1900
Gera	800
Gedaref	200
Harrar	3470
Darfur	4863
Bahr el Ghazal	886
Equatoria	2131
Total	40,490

The bulk of these troops were Egyptian, but there was also a fair percentage of Bashi-Bazuks, and a sprinkling of black soldiers.

The Egyptian troops were as bad as bad could be, and what wonder! The Sudan had for years been a place of exile for all persons whose presence in Egypt was not required, and in those despotic days crowds of officers, officials, and others, were sentenced to perpetual banishment to those distant regions.

As for the troops themselves, the bulk of them had been conscripted and enlisted in the ordinary way, but once a regiment was sent to the Sudan it might as well have been removed from the roster as regards it chances of relief. As a matter of fact, a regiment once despatched thence seldom, if ever, returned, and much the same remarks applied to its commander and subordinate officers.

What wonder then that a recruit should be accompanied from his village by his wailing relatives and friends. Was it a strange thing that the procession should be characterised by all the signs of Oriental grief which constitute a funeral?—when, indeed, in the majority of

instances it was in truth the villagers sad tribute to one of their community dragged from their midst by a cruel fate, to die speedily of disease or a deadly climate, or to live, perhaps, for long years, in hopeless exile from his happy village home.

The officers were for the most part illiterate men, ignorant of drill, and with little or no idea of maintaining discipline unless by a free use of the kurbash; the majority of them had been guilty of some political or military offence, which probably precluded them from all hope of advancement. Such a thing as military zeal and ardour was unknown; their main idea was to live at ease, and this could not be arrived at without resort to plunder and robbery—for they were seldom paid or at best they were years in arrears, as were also their men.

Is it then a matter of surprise that discipline, even of the most elementary kind, scarcely existed, and that these troops were guilty of almost every breach of the good order they were intended to preserve?

So much for the Egyptians; now a word for the Bashi-Bazuks.

The annexation of the Sudan by Mohammed Ali had been carried out for the most part by irregular Turkish troops, numbers of these had subsequently settled in the country, had intermarried with the inhabitants, and it is from their offspring that the heterogenous collection of irregular troops, known as Bashi-Bazuks, have sprung. The evil propensities of the Egyptians were accentuated a hundred-fold in these hybrid soldiers, who possessed many of the qualities of natives of the Sudan—chiefly a love of plunder and oppression—while their Turkish origin supplied the element of courage which, utterly uncontrolled, only served to make them still more oppressive to the wretched population they were supposed to keep in order.

The blacks, except in some of the more distant provinces, were too few in number to give any decided preponderance, and doubtless in their treatment of the natives, who were for the most part Arabs and their hereditary enemies, they were, perhaps, more oppressive than either Bashi-Bazuks or Egyptians. But it was no doubt this Bashi-Bazuk and black element in the Egyptian ranks which served in some degree to preserve the authority which the latter alone must have failed to possess, and probably had their numbers been considerably greater than they were, the fate of the Sudan might have been somewhat different.

Now this curious medley of garrisons were designated as "troops in occupation of the Sudan," and there is no doubt had their composition been better understood, the expression would not have been so misleading as it was to the British authorities when the Sudan question became inseparably connected with that of Egypt.

The industrious and peaceful Egyptian has a fatal talent for an exaggerated domesticity, and these troops in the Sudan were so many fathers of large families more or less properly acquired and domesticated in a foreign land. If they had not been in possession of weapons they might have made good colonists but the very possession of these weapons inclined them to tyranny. Their function was that of honest countrymen sharing in the villany of the brigands from the

Levant and Asia Minor, who wrung money, women, and drink from a miserable population.

Then there is another section of society which has also played an important part in the Sudan, this was the Coptic clerk ; whole families of these Bannias of Africa kept the accounts of Bashi-Bazuk plundering raids supported by Egyptian soldiers, and this constituted a government collecting its taxes.

Thus it will be observed that the principal elements of former Egyptian rule in the Sudan consisted of venality, oppression, and military weakness ; but there was yet another factor, perhaps more important than all the rest, which may be classed among the principal causes of the revolt—this was the suppression of the slave trade, to which here a mere passing reference is necessary.

Sir Samuel Baker, and after him General Gordon, occupied themselves with the suppression of this traffic, but when one considers the material—in the shape of Egyptian troops—with which they were to suppress a custom innate and inbred in the people, one can readily understand that it was entirely through the individuality and life-giving energy of these two men that a measure of success attended their noble efforts. But once they had left the country, back fell the Egyptians, an inert mass, and then followed the reaction.

The wild Baggara tribes, to whom reference has already been made, suffered most from this suppression ; they were the warm allies of the Danagla slave traders and merchants, and it was against the latter that Gessi's campaign in the Bahr el Ghazal had been more or less successfully waged ; but they had been dispersed, not destroyed, and when Mohammed Ahmed, the Dongola carpenter and fanatical fiki, began to disclaim against the oppression of the foreign rulers, these slave traders were amongst the first to flock to him.

Thus it was that with a little band of some 150 slave traders and religious devotees, this itinerant preacher, in May, 1881, suddenly declared himself to be the long-expected Mahdi, divinely sent to rid the country of its hated oppressors, and establish once more the true religion of the Prophet, purged from the pollution into which its renegade adherents had dragged it.

The early life of Mohammed Ahmed, the so-called Mahdi, is so well known that I do not propose to repeat it here. I will, therefore, pass rapidly on to a brief account of the principal events by which he so quickly rose to be ruler of the whole Sudan, and to be credited by almost the entire population as the true Mahdi : a position which was not without its effect on European—and certainly on English—politics and military operations.

It is supposed by certain people that the Arabi and Mahdi revolts being to some extent simultaneous as to their origin, they were, therefore, dependent the one on the other, and that Arabi was, in some remote manner, connected with the creation of the situation in the Sudan—but this is not the case. It is true that the existing conditions in both Egypt and the Sudan lent themselves to national movements. Both countries were under the same nominal sway, and no doubt much the same abuses existed in Egypt which existed in the Sudan,

but with this difference, that in the former the movement grew under the very eyes of Europe, and the causes which led to it were too apparent to be misunderstood; while the distance of the Sudan gave an air of obscurity to events which, owing to imperfect communications, were seldom understood aright. But looking soberly at the two revolts in the light of after-events, it is clear that they were quite distinct in their origin, though the causes which led up to them have many points of similarity. Misgovernment and maladministration of the army existed in both countries, and no doubt both movements are traceable in their origin to these two causes.

But if these abuses existed in Egypt, they were exaggerated tenfold in the Sudan. The officers and officials of the Sudan were of the same class as those of Egypt, but they were the worst of them, and the soldiers were either bad characters or permanent exiles.

Arabi, had he been capable of it, would have raised a Jehad in Egypt and, indeed, there is little doubt that though his revolt has been characterised as an attempt to throw off Turkish domination, it had also in it the elements of a pan-Islamic movement in so far as, on the one hand, it excited Turkish sympathy from the Sultan as Khalif, whilst on the other it raised Ottoman opposition in that Arabi was an Egyptian—as opposed to an Ottoman—nationalist.

The Arabi revolt was crushed ere it had time to develop. Mohammed Ahmed's movement would also, doubtless, have been crushed had it been subjected to such a treatment as the Egyptian national movement experienced at that period of its growth. But far from being crushed, every attempt on the part of the effete Egyptian garrison to cope with this national Sudan movement only served to weaken its resources and strengthen those of the Mahdi.

Not only were these wretched garrisons for the most part undisciplined and effete, but to these defects they added an entire disregard for the wary foes with whom they had to deal; they made that fatal mistake of underrating their enemies. Almost all the early events in the Sudan were nothing short of annihilation and disaster, mostly traceable to this ignorant folly on the part of the Egyptian commanders. What more obvious example of this blind self-confidence can there be than in the miserable defeat of Rashid Bey, the Mudir of Fashoda, who, on the 9th of December, 1881, was cut to pieces with his entire force. Drawn into the midst of a forest, he and his men were attacked by a comparatively small number of dervishes and massacred before they had even time to alight from their camels, and more extraordinary still, these dervishes were armed for the most part only with sticks. No wonder that a success like this should strengthen the people in the belief that the Mahdi could turn Egyptian bullets into water.

The limits of this paper do not admit of more than a passing reference to the principal military successes by which the Mahdi was raised to the elevated position of ruler of the Sudan, but I have ventured to supplement this article by a chronological list of the various battles and sieges which have taken place during the last ten years, and which have been compiled by Mr. W. C. Cartwright, C.M.G., from "Mahdiism and the Egyptian Sudan."

One glance at this list is sufficient to show what a confused welter of disturbance there has been in this unfortunate country, in which, as Father Ohrwalder says, "more than two-thirds of the population have disappeared through war, famine, and disease.

But let us turn for a moment to a brief consideration of the military system adopted by the Mahdi, which played such havoc with the Egyptian garrisons.

Mohammed Ahmed appointed three Khalifas, who were Commanders-in-Chief of the three sections into which his army was divided. The Mahdi himself had no distinctive insignia—neither flag nor drum ; but each Khalifa had his own special distinction : he had his Jehadieh or regular troops, his cavalry and lance-bearers, all from the tribe to which he himself belonged. Each had his own distinctive flag. The chief Khalifa—Abdullah's flag was known as the Raya Zerga, or Black Flag ; Ali's, the Raya el Hamra, or Red Flag ; Sherif's, the Raya el Hadra, or Green Flag. Each also had his own war-drums made of brass, and which were, therefore, called "nahas" in contradistinction to the ordinary drums known as "noggara," which are made of wood over which a piece of skin is tightly stretched.

Each Khalifa was in command of his own section and had numbers of emirs under him, all of whom had their different flags made of various colours, on which were embroidered the Moslem creed and generally a reference to the Mahdi. Each emir was assisted by several mukuddums or under officers, and each mukuddum also had his assistant.

These men can scarcely be called troops. The Mahdi had absolutely no knowledge or system of drill ; discipline of a wild and rough description existed it is true, and every individual follower was actuated by feelings of the wildest fanaticism ; life was of no account, for one and all believed that in dying they should go direct to Paradise, the joys of which the Mahdi did not fail to paint in the most glowing colours.

His plan was to attack in overwhelming numbers and to be regardless of all loss. At first the use of fire-arms was forbidden because the Prophet Mohammed had not used them in his early wars ; but a little experience soon served to dissolve this notion.

No sooner had the Mahdi arrived outside the walls of El Obeid, than he made a terrific onslaught on the garrison entrenched within the government buildings, but was repulsed with a loss of 10,000 men, and from this dates an entirely new departure in the conduct of the Mahdi's military operations. He now issued strict injunctions that his leaders should never order a town to be assaulted in the early stages of investment, but should rather wait until famine and disease had weakened the resisting powers of the garrison. How effectively he pursued this new policy with reference to El Obeid and subsequently to Khartum are now matters of history, and in the latter case it is very improbable the final assault would have been delivered when it was, had not the Mahdi, in desperation and terror of the advancing British troops, been driven to risk an action in which in his own words he anticipated the loss of half his force.

In his fights in the open, too, though he still adhered to his plan of drawing his enemy into an ambush, he now invariably employed his black rifle-bearing skirmishers to harass and worry his foe, whilst his sword and spearmen collected in some convenient depression or behind some rising ground, awaiting the favourable opportunity to charge.

The story of the terrible siege and eventual fall of El Obeid are too well known to need repetition here, suffice it to say that the capture of this town placed the Mahdi in possession of the entire province of Kordofan. Darfur, too, with its brave Governor Slatin, who had fought no less than 27 battles, was exhausted, and was only awaiting the final disaster of Hicks to surrender.

Already the spirit of revolt had permeated as far south as Bahr el Ghazal with the result that, a few months later, Lupton Bey, deserted by his garrison, was forced to surrender.

It was also about this time that the redoubtable Osman Digna was despatched into the Eastern Sudan with orders to raise the tribes. With what effect this ubiquitous leader carried out his instructions is now a matter of history; for upwards of seven long years he kept the slender Egyptian foothold of Sawakin in a state of almost constant siege; only to be eventually driven off some 18 months ago by a handful of Egyptian troops.

But whilst all these stirring events were going on in the Sudan, still greater changes had taken place in Egypt. Arabi had been crushed at Tel el Kebir, and Egypt was in occupation of British troops; the old Egyptian Army had been disbanded and a new one, under the Sirdarship of Sir Evelyn Wood, was in course of organisation. The number was fixed at 6000 men, Lord Dufferin pointing out with a sagacity which was justified later on, that this was irrespective of events in the Sudan.

Meanwhile Colonel Stewart had been sent to the Sudan to inquire into the condition of affairs; he arrived there on 16th December, 1882, and early in January, 1883, he wrote to Sir Edward Malet "the new year has begun unfavourably for Egyptian interest," and in a long series of exhaustive reports, perhaps, no man has been more exactly justified by events.

Still the situation never seemed to be realised, and in spite of the steadfast determination of the British Government not to become involved in the Sudan question, the fact that it was inseparable from that of Egypt, daily grew more and more apparent. It is not my place to discuss the political situation at this period, but I will pass rapidly on to military facts and to the unfortunate despatch of General Hicks and an armed rabble of 10,000 Egyptians into the Kordofan deserts. The utter annihilation of this force allayed all doubts as to the Mahdi's divinity and was the death-blow to Egyptian military authority in the Sudan. Space does not admit of a description of this terrible slaughter, but the main features of it are well known. Deficient in a knowledge of the military topography of the country, the doomed expedition, cut off from communication with its base on the river by illimitable deserts, its footsteps dogged by a dervish force which occupied each camp as it was evacuated, drawn on into a deep forest by false guides, it was

eventually surrounded by over 100,000 wild dervishes who, in one short quarter-of-an-hour, massacred nearly 10,000 well-armed but undisciplined and disheartened troops. Had the Hicks expedition never started, and had the troops of which it was composed been sent to garrison the various posts on the Nile to the south and east of Khartum, it is more than probable the Mahdi would never have arrived at being more than simple ruler of Kordofan and, perhaps, Darfur.

The day previous to the annihilation of the Hicks expedition, the storm burst in the Eastern Sudan. Near Tokar, more than 600 miles from Shekan, Commander Lynedoch Moncrieff and 148 Egyptians lost their lives at the hands of Osman Digna's forces and soon afterwards the Egyptian Government despatched Baker Pasha and a motley force to relieve the garrisons of Sinkat and Tokar, and open the road to Berber. A far inferior body of Arabs fell on this force of 3715 men and, in an amazingly short time killed 2373 of them; this disaster was followed shortly after by the fall of Sinkat and the massacre of the gallant Tewfik Bey and the whole garrison. Tokar was believed to be still holding out, and on 24th February, 1884, a British force, under Sir Gerald Graham, landed at Trinkitat, to learn that the town had just fallen; but five days later he attacked Osman Digna's force near El Teb and killed 3000 of them; the loss on the British side being 189 killed and 155 wounded. The force then returned to Sawakin and on March 14th it again fell on the Arabs at Tamai, when the total British loss was 220 and that of the Arabs over 3000. These were two severe blows to Osman Digna, but the withdrawal of the British force a few days later gave him an opportunity which he did not fail to make the most of. The following extracts from his despatches to the Mahdi describing these two actions are undoubtedly a lesson to us that withdrawal after a victory is tantamount to a defeat in the eyes of savage orientals.

Writing on the battle of El Teb, he says:—

"The English soldiers advanced to the Mamurieh, but they did not stay there long; God struck fear into their hearts, and they returned the next morning and went back to their steamers."

Then here is another extract showing the wild fanaticism by which his followers were possessed. He says:—

"In this battle we lost Magzub, he was a true and brave man and had no fear of death when fighting against the enemies of God. Before the battle he said to his friend 'if I am wounded before I get close to the infidels, then drag me by the leg until you get close to the battle-field, perchance I may be able to satisfy the desire of my heart and plunge my spear into the enemies of God, even as I die, and at the last moment of my life ere I leave the world to enter Paradise.'"

Osman Digna thus describes Tamai:—

"When the morning broke the English began firing their guns and rifles, the Ansar attacked them and fought them the whole day until both forces retreated; the English returned to Sawakin with a loss of 8000 men. In this battle the Ansar lost 2000 men and had a similar number wounded."

But it is out of the subsequent advance on Tamanieb that Osman

Digna makes the most capital. He says :—

"At the end of Jamad el awal, the English returned with a force of 13,000 men, but before they reached us God struck fear into their hearts, and they returned again to Sawakin without fighting, but only 5000 or 6000 of them reached Sawakin, the remainder were destroyed on the road, by what calamity is not exactly known, unless it was that the earth opened her mouth and swallowed them up."

He disposes of the final withdrawal of General Graham's force in a very summary manner :—"In short the English Army, with the exception of 5000 or 6000 men, was completely destroyed. They had about 28 steamers waiting for them in harbour, but on their return they only filled five of them, and the rest returned to their country empty."

Such evidence as the above is but one more instance which may be added to innumerable past experiences, all tending to prove that, no matter how complete a victory may be gained in fighting against savages, it is little better than useless if the victorious army retires.

After the victory of Tamai it was thought an attempt might be made to assist Gordon, telegraphing earnestly from Khartum that the road might be kept open. The weather was cool, the wells on the road were full, and everything pointed to an advance to Berber, which was still held by Egyptian troops. There was, however, considerable controversy as to the feasibility of the march, and the idea was eventually abandoned. At this period the retention of the town of Berber, for Gordon's plan of operations, was indispensable, but it was unfortunate that on his way up to Khartum he had communicated to the Mudir Hussein Pasha Khalifa, the terms of the proclamation authorising the abandonment of the Sudan ; that the knowledge of this proclamation had the effect of turning the already wavering tribes in the neighbourhood over to the Mahdi, cannot be doubted. On 26th May the town was stormed and carried, and a horrible massacre of men, women, and children followed.

All this time the Mahdi was still at El Obeid, but in Father Ohrwalder's words "The news that Berber had fallen and that General Graham had returned to Sawakin, decided the Mahdi to advance on Khartum."

The refusal to send up Zubeir Pasha and the fall of Berber, by which telegraphic communication with Khartum was cut off, practically sealed the failure of Gordon's mission, and from this date a veil closed down on him, Stewart, and Power, cheerfully setting to work to hold out till Providence should relieve them. Baffled on all sides, Gordon and his long-suffering troops sustained a siege with a courage that soldiers of all nations have admired.

The details of this memorable siege are too well known to need repetition, the story has already been summed up in the following words, "To innumerable enemies flushed with victory and ardent fanaticism, Gordon opposed a skill and experience in savage warfare which few could equal. Ill-provisioned in a place naturally and artificially weak, Gordon alone (for his colleague Stewart had been treacherously murdered) for months preserved an undaunted front. Neither treachery in the besieged nor the stratagems of the besiegers

caused the fall of Khartum. The town fell through starvation and despair at long neglect."

The fall of Berber had practically closed the shorter route *viâ* Sawakin, and late as the British expeditionary force was in starting *viâ* the Nile, it all but succeeded in its object. Lord Wolseley, in his final despatch, says, "The army under my command was unable to accomplish the object set before it, and to save the lives of the gallant General Gordon and the garrison of Khartum, but this was from no fault of its own, and no lack of courage, of discipline, of dash, or of endurance. It overcame physical difficulties of the greatest magnitude, it swept from its path in every encounter an enemy almost its equal in bravery and greatly its superior in numbers, and its advanced guard reached the outskirts of Khartum only two days too late."

Thus the bold attempt to snatch the prey from the lion's mouth failed; the town was stormed and taken on 26th January, 1885, and its heroic defender and some 10,000 of the garrison and inhabitants put to the sword.

The British expedition now retired and occupied a chain of posts along the Nile; the intention being to return after the hot weather was over and capture Berber. In conjunction with this plan it was decided to despatch another British expedition to Sawakin, which was to eventually join hands with the Nile forces and compass the final downfall of the Mahdi.

The principal incidents in this second Sawakin expedition were the actions of Hashin on 20th March and Tofrik on 22nd; the occupation of Tamai, and the advance on Otao and T'Hakul.

But now the evacuation of the Sudan was finally decided upon, and General Graham's force began withdrawing from Sawakin on 17th May, while by 15th June the last British troops had left Dongola for the north.

After the fall of Khartum only two strong places remained in the hands of the Egyptian troops—Sennar and Kassala—and both were closely besieged. The former fell in August, 1885, and the latter in September, and throughout these long sieges the conduct of these garrisons is a bright example of endurance and fortitude.

The Mahdi, however, immediately after the fall of Khartum, gave himself up to a life of ease and luxury, in which the unfortunate women captured in Khartum played an important part. A victim to his debauchery, he died on 22nd June, 1885. In Ohrwalder's words, "he had left behind him a hundred thousand massacred men, women, and children, hundreds of devastated towns and villages, poverty and famine. Upon his devoted head lies the curse of his people whom he had forced into a wild and fanatical war which brought indescribable ruin upon the country and which exposed his countrymen to the rule of a cruel tyrant from whom it was impossible to free themselves."

The Khalifa Abdullah, in accordance with precedent, succeeded the Mahdi, and this occasioned no small party strife and discord between him and the other two Khalifas; but strong measures were taken; the two rivals were divested of all power, reduced to quite a subordinate position, and Abdullah soon showed that he would allow no one else to share his authority with him.

Abdullah's watchword now became "*ed din mansur*" (*i.e.*, religion is victorious), and what prestige the new propaganda had lost by the death of the Mahdi was amply compensated for by the rigorous severity and tyranny of the new Khalifa's rule.

His first step was to "bring into the way of truth" a few of the tribes who still held aloof from Mahdiism; this necessitated some punitive expeditions, which were little more than wholesale butchery, whilst the captured women and children were carried off into slavery.

But this policy soon brought evil in its train; constant warfare had caused a neglect of cultivation, besides a large percentage of the fertile districts had, by these severe measures, become depopulated, and for almost a year a terrible famine ravaged the land, and in Ohrwalder's opinion the population of the Sudan is now between 60 and 70 per cent. less than it was in 1882.

The military ardour of the new ruler was not, however, to be abated, and the following account by Ohrwalder of a review of dervish troops on the return of a successful expedition shows that Abdullah's power was by no means on the wane at that period. He says, "Then the march-past began. Upwards of 31,000 black troops, armed with Remington's and formed up in long lines, went by to the sound of drums and trumpets, but the latter, on which the players attempted to produce some specially dervish music, raised the most discordant sounds, which gave an intensely comic aspect to the whole proceeding. Each emir with his flag rode at the head of his division. . . . . When the Jehadieh had passed, the sword and spearmen followed, some 20,000 in number, then came the inhabitants of Omdurman in countless numbers. There could not have been less than 60,000.

After the march-past all were formed up again, and then the Khalifa, dismounting from his camel, stood on his sheep-skin and conducted prayers. The shout of "Allahn Akbar," "Allahn Akbar," from 100,000 throats was impressive in the extreme, and, as the sound rolled down the immense lines, it was echoed again and again through the hills, lasting for over a minute after each shout.

On the conclusion of prayers, the guns pealed forth salutes, and such wild fanaticism and enthusiasm prevailed that several men dashed up to the very muzzles of the guns and were blown to pieces. Of course, the Khalifa announced that the souls of these stupid people had gone straight to Paradise. The salutes over, the lines were once more inspected, and then all the flags were collected in one place, in the centre of which stood the Khalifa; this was the signal for the whole force to gather round and vie with one another in their shouts of loyalty that they would die a hundred times over for him and his cause. Khalifa Abdullah became so wildly impressed by the enthusiasm of these savage hordes that he could scarcely contain himself, and it was as much as his body-guard could do to keep the impetuous crowds from crushing him to death. . . . ."

The annexed rough plan of Omdurman shows the place where such reviews are held, and a brief study of the various references will give the reader some information concerning the Khalifa's capital which it is unnecessary to repeat here.

A PLAN OF OMDURMAN

Drawn in the Intelligence Department, Egyptian Army

from descriptions given by natives and revised

by Father Ohrwalder

Scale $\frac{1}{14400}$ or 1 in to 400 yards

A PLAN OF OMDURMAN

Drawn in the Intelligence Department, Egyptian Army
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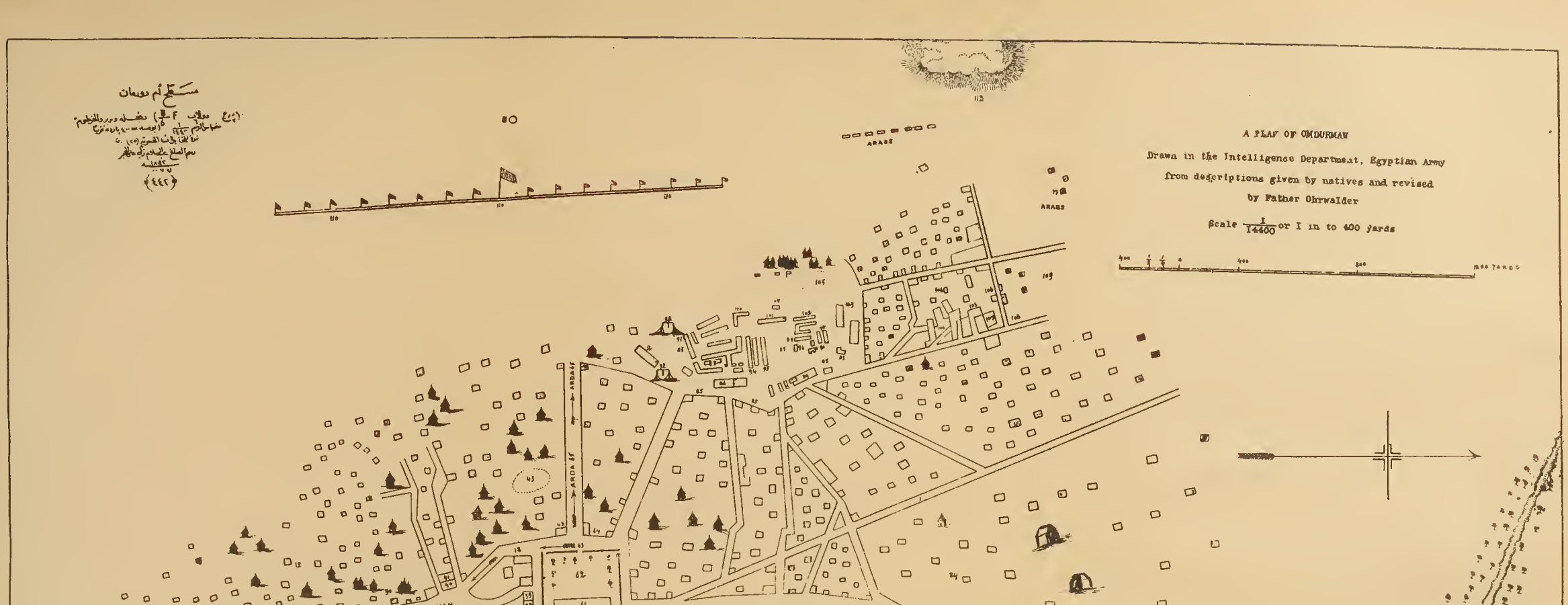
Scale $\frac{1}{14400}$ or 1 in to 400 yards



NAMES OF PLACES REFERRING TO FIGURES IN PLAN

1. Village of EL FATEHAT
2. The HADRA TREE where the MAHDI beheld Visions and where it is said GORDON'S HEAD was suspended
3. Open Space on which the STANDARDS of all expeditions going SOUTH are planted.
4. OMDURMAN FORT
5. Quarters of the Regular Soldiers or GEHADIEH
6. House of EMIR ABDULLAH WAD IBRAHIM
7. House of EMIR ADDE MAULA (ENTOUR of ABU ANGA)
8. BIN ABU BATJL tree
9. One of KHALIFA MOUSLAN'S houses
10. ABU ANGA'S Square
11. BIG HOUSE of the EMIR NUR ANGARA
12. HOUSES of the various sections of the BAGGARA tribe.
13. BOUSEIH FACTORY
14. KADI of BENNA'S house
15. HOUSES of IDRANIA FUSHA TAUZI
16. Quarters of the MAHDI'S Artillery and EMIR
17. Arab Huts
18. The KHALIFA'S carriage road to the GAHADIEH Mosque and Fort
19. KUAY for boats travelling SOUTH.
20. HOUSE of EMIR NAGGAN HUSSEIN and his tribe.
21. Coffee Shops
22. HOUSE of EMIR HAT KHALID & quarters of AMARAR Arabs
23. Coffee Shops
24. HOUSE of EMIR YAKUB ETTAIBNI
25. HOUSE of HAMID ENNIL & quarters of AHAMIN Arabs.
26. The Artillery Store
27. The BEIT EL AMANA (or Arsenal), powder factory and Stores for valuable articles.
28. The NAGARA or (brass drum) Store.
29. THE BEINAK or (Standard) Store
30. HOUSE of BLATIN BEY.
31. THE PRISON.
32, 32A. HOUSE of THE KADI of ISLAM and his mosque. PALACE AND ENCLOSURE OF KHALIFA ABDULLAH
33. = of EMIR YAKUB ETTAIBNI
34. " of " YUNIS WAD ED DEKEIM.
35. " of " ZAKI TUMMAL.
36. " of " OSMAN WAD ED DEKEIM
37. SMALL HOUSE of KADI AHMED
38. HOUSE of EMIR SAYED HAMED
39. " " " AHMED ALI
40. " " " ABU ANGA'S family.
41. The TABIEH (RAG HOUSES for four people)
42. HOUSE of EMIR OSMAN WAD ADAM.
43. SUR EL ARDA
44. MOSQUE on East bank
45. REST HOUSES for travellers
46. One of the KHALIFA ABDULLAHI'S houses.
47. Open Space in which the Standards of expeditions going to GALABAT and the Eastern SUDAN are planted.
48. HOUSE of EMIR AHMED BHUKR & his Arabs.
49. HOUSES of towns people of DARA & EL OBEID
50. " of the DANAGLA Quarter.
51. HOUSE of AHMED BHARFI
52. " of EMIR KHALED ZOGAL
53. DANAGLA Quarter.
54. One of KHALIFA ALI WAD HELU'S houses
55. HOUSE of AHMED SULEIMAN (EMIN BEIT EL MAL) and his men.
56. One of KHALIFA ALI WAD HELU'S houses.
57. HOUSE of the KHALIFA ALI WAD HELU and Quarters of DEGHEIM & KENANA Arabs
58. HOUSE of the MAHDI'S funeral.
59. The MAHDI'S tomb
60. The IRON MOSQUE, made of all the Iron plates collected in KHARTUM.
61. The MINBAR or NICHE, marks the direction of MECCA.
62. The GREAT MOSQUE
63. West door of the MOSQUE
64. The Quarters of the BATAHIN, HOMR & ZAGAWA Arabs
65. ROAD to the ARDA or parade ground.
66. Wood Store.
67. Soap Factory
68. Quay for boats going NORTH
69. One of KHALIFA ABDULLAH TAISHI'S houses
70. Quarters of the KAMLIN Arabs
71. " of WAD ABU DIN & WADEL KERIM & DHUKHIEH Arabs.
72, 73. " of BATTAHIN, HOMR, and ZAGAWA Arabs.
74. Arab Huts of Camp followers
75. Open Space in which the Standards of all expeditions going NORTH are planted, and NORTH NUBA or place where people collect before quitting OMDURMAN on expeditions.
76. HOUSE of OSMAN DIGNA.
77. Slave Market.
78. BEIT EL MAL - Lithograph press - general Stores
79. Grain Store.
80. Quarters of DARFUR & KEBKEBIEH people
81. HOUSE of EMIR WADEL [illegible] & quarters of his people
82. " " " WAD NAGANI & quarters of the RUFIA Arabs
83. " " " WAD NEJUMI & " of the JALIN Arabs
84. " " " ELIAS PASHA
85. Market Courts of justice
86. Carpenter's Shops.
87. Forage Market.
88. Grain and Date Market.
89. Grain and Date Stalls.
90. Cigarette Shops.
91. Tent Bazar
92. Coffolds.
93. Linen and Cloth Market.
94. Hatters Shops.
95. Tailors Shops.
96. Cloth Shops
97. Salt Market
98. Coffee Shops
99. Smiths Shops.
100. Vegetable Market.
101. Butchers Shops
102. European Cook Shops.
103. Wood Market
104. Butchers Shops
105. Women's Market
106. The MUSLIMANIEH Quarter (in which all persons, European and others who have turned Moslems, live.)
107. HOUSE of FATHER OHRWALDER
108. Quarters of MESALLAMIEH & ERRAR Arabs.
109. Cemetery
110. The great parade place of the MAHDI'S troops
111. WELL
112. The place in which EL KABIR appears to the KHALIFA in vision.

At about this period, the Khalifa was probably at the zenith of his power, and was induced to enter upon a prolonged campaign against Abyssinia, in which several battles were lost and won on both sides. In the great battle of Galabat, fought on 9th March, 1889, King John personally commanded the Abyssinians, but in the moment of victory he fell mortally wounded; his force retreated, was pursued and heavily defeated by the dervishes, who captured the King's body and an immense quantity of loot.

Whilst the Abyssinian Campaign was going on, a serious revolt broke out in Darfur, headed by a certain Abu-Gemaizeh, who was erroneously identified as a son of Sheikh Senussi. For a time great success attended this movement, but on the death of its leader from small-pox, it was without difficulty suppressed.

Successful to the south, east, and west; the Khalifa now turned his attention more seriously to the invasion of Egypt. On the evacuation of Dongola in 1885, the wave of Mahdiism had poured into that province, but received a severe check at Ginnis, where a combined British and Egyptian force, under General Sir F. Stephenson, utterly routed the advanced guard of Mohammed el Kheir's force, but the Frontier Field Force retired subsequently to Halfa and Assuan. Nejunu—perhaps the most celebrated of the Mahdiist emirs—succeeded to the command of the Northern Dervish Army on the death of El Kheir, and in November, 1886, his advanced guard occupied Sarras. On 28th April, 1887, they were driven out of this position by an Egyptian force under the command of Colonel Chermside, and from that date up till July, 1889, the Egyptian frontier was perpetually harassed by dervish raids and attacks which the Frontier Force under the command of Colonel Wodehouse, R.A., was exclusively employed in successfully combatting; for in May, 1886, English troops had evacuated Halfa and Korosko, and the last small detachment was finally withdrawn from Assuan in January, 1888.

It may truthfully be said that this trying work on the frontier and also at Sawakin (to which I shall presently refer) was the means of making the Egyptian Army what it now is. And here, perhaps, is a fitting opportunity to briefly describe some of the principal features of this small force which has justly achieved some fame as a reliable fighting machine.

The first question that will naturally arise is, "How is it that the same class of soldiers who so completely failed to hold Egypt and the Sudan a few years ago has now so entirely changed?" The answer is simple:—The material is the same, but the treatment, training, and command, are absolutely different.

One of the first reforms which the original Sirdar, General Sir Evelyn Wood, took in hand was a strict adherence to the laws of conscription and recruiting; the terms of service were definitely arranged, and, with a slight modification, rigorously maintained. A soldier no longer serves indefinitely in the army: after six years' service with the colours he is transferred to the police, which is the first class army reserve, and after five years' police service he is transferred to the general reserve for four years; this means that he will return to his

village at the end of eleven years' service. Once in the army he is well-clothed, well-fed, and well-housed : his pay is small, but sufficient for his wants, and, above all things, he is justly commended or punished according to his conduct. The belief in his Commanding Officer has given birth to a feeling of confidence which may scarcely be said to have previously existed, except in a few stray cases where a good native Commanding Officer was capable of inspiring it. It is, however, only just to pay this tribute to the long and dogged resistance made by some of the garrisons in the Sudan ; notably those of El Obeid, Khartum, Sinkat, Sennar, and Kassala. "Initiative the Egyptian has not, decision he has not ; but placed in a position in which he must quickly commit himself on a question of life and death, he, with confidence in his commander, will endure with fortitude." Nay, more —if carefully trained and well treated, as he has been for the last ten years, it has been proved that he is a reliable fighting man—not only behind walls, but also in face of that same enemy who has been described as "almost the equal" of the British soldier in bravery. It should, however, be remembered that the Egyptian Army is not a purely Fellahin Army : enrolled in its ranks are five Sudanese battalions, recruited for the most part from the great fighting tribes—the Dinka and Shilluk—and there are also men in these battalions from Bornu, Borgu, Wadai, Darfur, and Equatoria ; men whose bravery and dash it would be difficult to match anywhere, whose main idea when an enemy appears is to be "up and at them," and the British officers who command these sturdy negroes find their duty in action lies principally in endeavouring to restrain their impetuosity.

Different, indeed, are the characteristics of the two races, but it has been shown, on more than one occasion, that they form a valuable fighting combination.

The Egyptian Army, as at present organised, is under the Sirdarship of Brigadier-General Kitchener, and consists of eight battalions of Egyptians and five of Sudanese. There are six batteries of artillery, until recently commanded by Lieut.-Colonel Rundle, R.A., but on the latter becoming Adjutant-General, he has been succeeded by Major Parsons, R.A. There are ten troops of cavalry, besides various staff and departmental details, which go to make up the present strength of 582 officers (of whom 75 are English) and 12,320 men.

But to return to events in the Sudan. The cessation of hostilities with Abyssinia and Darfur enabled the Khalifa to push forward the force intended for the conquest of Egypt.

The detail of events connected with Nejumi's wild project are too well-known to need repetition here. At the head of some 14,000 souls, of whom more than 50 per cent. were merely camp followers, he swept into Egypt, to meet first a severe reverse at the hands of Colonel Wodehouse just across the border, and then to suffer terrible losses by hunger, thirst, and desertion, whilst penetrating some 60 miles of waterless desert into Egyptian territory, and finally to suffer almost complete annihilation at the hands of General Sir Francis Grenfell, Sirdar, at Toski, on 3rd August, 1889.

In this action fell Nejumi himself—probably the greatest of all the

dervish fighting leaders, the conqueror of Hicks and the director of the assault on Khartum.

From this date, with the exception of an occasional raid, the Egyptian frontier has been quiet; the dervish advanced post is now at Suarda, upwards of 100 miles south of Halfa, though their patrols generally come north as far as Akasheh. Such is the present disposition of the Northern Dervish Force.

The oft-resuscitated Osman Digna, too, after the withdrawal of the British expedition in 1885, held Sawakin more or less in a state of siege. Several minor actions took place almost under the walls, and, in December, 1888, a combined British and Egyptian force was again obliged to assemble to drive the dervishes out of the trenches which they had made within 800 yards of the advanced works.

Still the state of siege continued, and it was not till February, 1891, that a small Egyptian expeditionary force, under the command of Colonel Holled Smith, succeeded in inflicting a severe defeat on Osman Digna at Tokar, which caused his force to disperse towards Berber and Kassala, and left the Egyptian troops in possession of the fertile Tokar delta; thus at length a period of peace has fallen upon that unfortunate neighbourhood which has been, for upwards of seven years, the scene of almost constant warfare.

In the south-east, Kassala is still held by a small dervish garrison, whilst Italian influence has already penetrated sufficiently far to cause the Khalifa considerable anxiety in that direction.

As regards Equatoria, for upwards of two years after Stanley's departure, little was known of events in that far-distant province, but recently the pioneers of the British East Africa Company have succeeded in securing the services of a large portion of the old Equatoria garrison, which is now employed in holding Unyoro and Uganda. Some 400 of Emin's old mutinous troops are still at Wadelai in an independent position, whilst the most southerly dervish post is at Regaf, but is cut off from the north by the revolt of the Dinka and Shilluk tribes, who are causing much trouble to the dervish garrison at Fashoda.

El Obeid, to which reference has already been made, is now the western limit of the Khalifa's dominions, which are clearly less extensive than they were a few years back. Constant warfare has, no doubt, considerably reduced his power to undertake offensive movements on a large scale; but it is probable he will be better able to govern his now curtailed territories, and he is said to be capable of profiting by past experience. He is endeavouring to encourage cultivation and to make himself, as far as possible, independent of external communication. His policy is to strengthen his own power, and concentrate it in the hands of his own tribesmen, the Baggara. These Baggara are now, no doubt, in absolute military occupation of the Sudan, and they rule its unfortunate inhabitants with a ruthless tyranny, which makes the latter long for a return of the Egyptian power which they so heedlessly cast off.

The Sudan peoples are not, as is often supposed, united under their present ruler, and, strong as the Baggara power is at present, the

continual dissensions between them and the rightful owners of the soil are no doubt a source of weakness which, in the event of military operations on the part of Egypt, might be turned to good account; but full allowance must also be made for the fact that, ready as those tribes and people hostile to the Baggara rule are to side with any movement which would set them free, they are not now in a sufficiently strong position to take the initiative in any such movement; and, indeed, so completely are they under the thumb of the Baggaras that it is fair to assume that, in the event of hostile operations in the Sudan, a foreign invading force—Egyptian or other—would have to be prepared, not only for the opposition which the Baggara would offer, but also for that of, perhaps, 30 per cent. of the local population of the district in which operations are being conducted, who, though they have all the desire to throw in their lot with a successful invading force, are too much coerced by their present rulers to be able to give effect to their wishes.

Such is very briefly the existing military situation in the Sudan, and I now propose to conclude this article with a few remarks on the military force and war material at present at the disposal of Khalifa Abdullah.

The nucleus of the Khalifa's army is composed for the most part, of the Jehadieh, or regulars, who are all armed with rifles, and are almost entirely blacks, while his spear and swordsmen consist mainly of Arabs of some 50 or 60 different tribes; but of these the most trusted are the Taaisha and Habbanieh Arabs.

The Jehadieh are composed partly of the old Government Sudanese troops and partly of men recruited from the southern districts subsequent to the abandonment of the Sudan. The latter are gradually replacing the Government troops, of whom the proportion is now about four to one; none of the old Egyptian soldiers are admitted into the ranks, they are employed for the most part as cooks, servants, water carriers, &c.

The Khalifa has gradually recognised the fighting value of the black troops, and has recently issued an order that no able-bodied black is to be sold as a slave, but that he will give 30 dollars a head for blacks suitable for soldiers. All blacks recently enlisted are branded with the word Abdullah on the left hand.

There is no special uniform, all men are dressed alike, whether soldiers or not. The dress consists of:—

The jebbeh, or marrakaieh, a long shirt made of dammur, or native cloth, and covered with patches of various colours.
The sirual, or drawers.
The sayidan, or sandals.
The karabah, or girdle of goos (straw).
The takieh, or white skull cap.
The immeh, or turban.
The sibha, or beads.

The Jehadieh, or regulars, are armed with rifle and bandolier only,

while the Arabs are armed with sword, long lance or kibbis, four small spears or tabaig, and a small dagger.

There is no cavalry organisation. A certain number of Arabs have horses, and if a certain number of horsemen are required, an order is merely issued to the emirs of rayas that they are required to supply so many. They are armed in the same manner as the foot men.

Food, in the shape of dhurra, is supplied only to the regulars, and to the Taaisha and Habbanieh Arabs; the other Arabs are obliged to find their own food. The daily ration per man is an Egyptian kaddeh, roughly, two handfuls.

Pay is not issued to the troops regularly. There is no scale of pay except amongst the Jehadieh. Each man nominally receives $\frac{1}{8}$th of a dollar (about 6d.) a month, but frequently he receives nothing. Emirs receive from 20 to 100 dollars a-month, according to their respective status, with which they are intended to relieve the pressing wants of their poorer adherents, but, as a rule, the money generally remains in the hands of those to whom it is issued in the first instance.

There is practically no system for transporting food on an expedition. Each emir is held responsible that his men have a sufficient number of donkeys or camels—their individual property—to carry some days' supply. As a general rule it may be estimated that for every man there are three women, children, or camp followers. These latter are the carriers, or perhaps they are fortunate enough to possess a donkey or camel. Each man is supposed to have his own girbeh or water skin. If he is too poor to obtain one, his emir must supply him.

Guns, Ammunition, &c.

There are in all in Omdurman over 100 guns, but of those a large number are at present useless, though it is possible to repair them. Of the guns now in use there are, approximately—

30 mountain guns.
2 mitrailleuse.
3 Krupp.
4 machine guns.

There are a very large number of rifles, both Remington and various other kinds; but not more than 8000 Remingtons are in good repair, and, perhaps, 4000 rifles and guns of various descriptions.

Rifles are only carried on the special Friday parades; at other times they are kept in the barrack stores, and in charge of the emirs and mukuddums.

There are only about 250 boxes of old Government ammunition left in Omdurman, and this want of ammunition is one of the main difficulties with which the Khalifa has to contend.

A certain Greek, named Yusef Perterachi, after many attempts, at length succeeded in making powder of a fair quality, but was accidentally killed in the explosion, which took place on 26th January, 1891, in Omdurman.

Yusef Perterachi's successor, as head of the powder factory, is a certain Hassan Sharkasi.

After the explosion the powder factory was removed from Omdur-

man to Tuti Island; but the powder when made is stored in barrels and placed in a special store near the Beit-el-Mal.

Lupton Bey was forced to teach some dervishes how to manufacture fulminate, and, after his death, this work was carried on by a certain Ahmed Zeki.

Neufeld, who is heavily chained, is working at the manufacture of saltpetre, which is carried on in the old Austrian mission church in Khartum. There are also saltpetre pits worked by Takruris at Kalakla and at Halfiyeh.

Powder is made at the rate of about eight kantars a-day, and there is in consequence plenty of it, but the great difficulty is lead, of which the supply in the Sudan is entirely exhausted. An attempt was made to make bullets with a mixture of copper and iron, but these were found to be useless, and up to the time Father Ohrwalder left, the difficulty had not been overcome.

Cartridge cases are made near the Beit El Amana by a certain Suliman Abdullah; caps are made by the jewellers.

The old dockyard in Khartum is still used for the repair of the steamers, manufacture of iron work and general repairs. The workmen are mostly old Egyptians and black apprentices, the general direction being under Abd El Sayid, late clerk of El Obeid.

Spears and swords are made in large quantities in the bazaar in Omdurman by the Tama blacks from Darfur; the long spear (kibbis) varies from two to 15 dollars, the tayara (bundle of small spears) from three to five dollars.

Battles and Sieges in the Sudan, 1881-91.

Page.	Names.	Year.	Date.	Description.	Guide to locality.
16	Abba Island.	1881	August	Abu Saoud and 200 men destroyed by the Mahdi.	W.N.
17	Jebel Gedir.	"	Dec. 9	Rashid Bey, Governor of Fashoda, defeated by the Mahdi.	K.
18	Sennar.	1882	Apr. 6	Sortie under Hussein Bey Shukri repulsed by Ahmed el Makashif, emissary of the Mahdi.	B.N.
"	"	"	"	Saleh Bey entered Sennar after desperate encounter with the Makashif.	"
"	Messalamieh.	"	"	Rebels defeated Saleh Bey and Awad el Kerim Abu Sin with great slaughter.	"
"	Abu Harar.	"	May 3	Geigler Pasha's victory.	"
"	near Sennar.	"	" 25	" " second victory.	"
19	Kashgil.	"	" 13	Siege of El Birket temporarily raised, after three days fighting, by Nazim Effendi.	K.
"	Ashaf.	"	" 19	Village pillaged; inhabitants massacred. Bara troops defeated. Nur Angara escaped.	"
18	Jebel Gedir.	"	June 7	Yussef Pasha esh Shellali and 6000 men from Kana utterly destroyed by the Mahdi.	"
20	Bara.	"	" 23	Sheikh Rahama's attack repulsed by Ali Bey Sherif with 2000 men.	"
24	Gor el Maahlieh.	"	" —	Rebels defeated by Egyptian garrison retreating from Shakka.	D.
20	Awlad Muriz.	"	" —	Sheikh Rahama defeated near Bara.	K.
"	Shattura.	"	July 7	Sorties from Bara against Emir en Nur.	"
		"	" 11	Bombardment of Alexandria.	
24	Ell Allali.	"	" —	200 of Shakka garrison annihilated.	D.
19	Shatt.	"	Aug. 8	Station taken by the Makashif. Garrison of 200 men killed.	W.N.
"	Duem.	"	" 28	Attack on garrison repulsed. 3000 Arabs killed and wounded.	"
22	El Birket.	"	" —	Capture of Birket. 3000 men killed. 1000 escaped.	K.
25	Darra.	"	" —	Madibbo defeated by Slatin Bey. 2000 killed.	D.
"	"	"	" —	Further defeat after arrival of reinforcements.	"
22	El Obeid.	"	Sept. 8	Assault by the Mahdi repulsed with great loss.	K.
		"	" 13	Battle of Tel el Kebir.	
28	Tel Gauna.	"	Aug. 18	Bashi Bazuks defeated by Sheikh Jango.	E.P.
"	Meshra er Rek.	"	" —	Lupton Bey's Baringers destroyed by Janghe tribe.	"
29	Tel Gauna.	"	" —	Sheikh Jango defeated by Abdullah el Mehallawi with 2000 men. 600 killed.	"
54	Bara.	1883	Jan. 5	Surrendered by Surur Eff. to Wad en Nejumi.	K.
55	El Obeid.	"	" 17	Surrendered by Mohammed Said Pasha to the Mahdi.	"
73	Karasa.	"	" 18	Egyptian troops defeated.	B.N.
"	Maatuk.	"	" 27	Abdel Kader Pasha's victory. 600 killed.	"
"	Meshra ed Dai.	"	Feb. 24	Abdel Kader Pasha defeated Makashif with loss of 200 men. Siege of Sennar raised.	"
"	Jebel Sekhedi.	"	Mar. 4	Makashif defeated by Saleh Bey.	"
75	Marabieh.	"	Apr. 29	Makashif defeated by Hichs Pasha and killed.	W.N.
94	Sinkat.	"	Aug. 5	Attack on Sinkat repulsed by Tewfik Bey.	S.
97	El Fasher.	"	" --	Defeat of Mudir's troops.	D.
94	Handub.	"	Sept. 9	Rebels defeated by Tewfik Bey on Erkowit road (near Sinkat).	S.
101	Dembo.	"	" —	Ruffai Agha and troops massacred.	E.P.
94	Sinkat.	"	Oct. 16	Reinforcements destroyed in a defile. Only 25 escaped.	S.
"	El Teb.	"	Nov. 4	550 men under Mahmoud Pasha Sahir defeated on road to Tokar. Death of Commander Moncrieff, R.N.	"

Page.	Names.	Year.	Date.	Description.	Guide to locality.
83	SHEKAN.	1883	Nov. 5	Hicks Pasha's expedition destroyed by the Mahdi. Nearly 10,000 killed.	K.
?	Atbara.	"	" —	Battle between Osman Digna's Emirs and the Egyptians.	N.
95	Tamanib.	"	Dec. 2	Destruction of 200 Bashi Bazuks and 500 blacks by 3000 Arabs.	S.
99	Omshanga.	"	" —	Surrendered.	D.
"	Darra.	"	" —	Surrendered by Slatin Bey to Togal.	"
101	Dembo.	"	" —	Arabs defeated by Lupton Bey.	
"	Kassala.	1884	Feb. 1	Sortie from Kassala against Mustafa Hadal. 900 soldiers killed.	A.F.
92	Tokar.	"	—	Siege of.	S.
95	EL TEB.	"	" 4	Defeat of Baker Pasha with 3700 Egyptians and Turks. 1400 escaped.	"
131	El Fasher.	"	Jan. 15	Surrendered by Said Bey to Togal.	D.
117	SINKAT.	"	Feb. 8	Fall of Sinkat. M. Tewfik Bey and the garrison cut to pieces.	S.
		"	" 18	General Gordon arrived in Khartum.	
"	EL TEB.	"	" 29	Sir G. Graham with 4000 British troops attacked by 6000 Arabs. 1500 killed.	"
"	Tokar.	"	" —	Fall of Tokar.	"
118	TAMAI.	"	Mar. 13	Sir G. Graham with British force attacked by 12000 Arabs. One square was broken, but Arabs were defeated and 2000 killed.	"
110	Khartum.	"	" 16	Defeat of General Gordon's troops.	K.H.
136	Bahr el Ghazal.	"	Apr. 28	Surrender of Lupton Bey.	E.P.
151	Gedharef or Suk abu Sin.	"	" —	Garrison of 200 under Mohammed Agha Pasha made terms with the rebels.	A.F.
129	Kalakala.	"	May 3	Defeat of Abu Girgeh by General Gordon.	K.H.
121	BERBER.	"	" 26	Captured by Dervishes. General massacre.	N.
149	Sawakin.	"	" —	Major Chermside besieged.	S.
150	Khatmieb.	"	June 21	A suburb of Kassala. Rebels repulsed by Sheikh Osman el Morghani.	A.F.
133	Jebel Marra.	"	" —	Besieged by Adam Amer. Sultan Dudbenga captured in September.	D.
?	Hashin.	"	May —	Mahmud Ali defeated by Osman Digna.	S.
123	Debbeh.	"	July 5	Heddai repulsed by Egyptian garrison.	N.
126	KORTI.	"	Aug. 31	Mudir of Dongola defeated 3000 rebels. Heddai killed.	"
156	Gereif.	"	Aug. 30	Mohammed Ali Pasha's victory on the Blue Nile over Abdel Kader.	K.H.
157	Halfiyeh.	"	" 31	Mohammed Ali Pasha defeated Sheikh el Obeid.	"
"	EL FUN (or Om Debban).	"	Sept. 5	Mohammed Ali Pasha with 800 men defeated and killed.	"
158	Hebbeh.	"	" 18	Massacre of Colonel Stewart's party by Suleiman Wad Gamr and others.	N.
152	Harrar.	"	Oct. —	Evacuation conducted by Major Hunter. Radwan Pasha defeated Babh tribe.	
162	Shendi.	"	" —	Besieged by General Gordon's steamers.	N.
147	Amadi.	"	Nov. —	Repulse of Arabs by Emin Bey's troops.	E.P.
149	Sennar.	"	" —	Siege of Sennar by El Merhdi.	B.N.
242	Galabat.	"	Nov. & Dec.	Severe engagements. Egyptians and Abyssinians *v.* Arabs.	A.F.
172	ABU KLEA.	1885	Jan. 17	Sir H. Stewart attacked by a large Arab force. Decisive English victory.	N.
		"	" 19	Sir H. Stewart mortally wounded.	
"	ABU KRU.	"	" 19	Defeat of Nur Angara by British troops.	"
171	KHARTUM.	"	" 26	Fall of Khartum. General massacre. Death of General Gordon.	K.H.
188	Wad Habeshi.	"	Feb. 3	Lord C. Beresford's action in relief of Sir C. Wilson's party.	N.
244	Galabat.	"	" —	Relief of Galabat by Major Saad Rifaat and an Abyssinian force.	A.F.
200	KIRBEKAN.	"	" 10	Successful action by British troops. Death of General Earle.	N.
241	Massawa.	"	" —	Occupied by Italians. Egyptian garrison withdrawn.	A.F.

Page.	Names.	Year.	Date.	Description.	Guide to locality.
245	Hashin.	1885	Mar. 20	Osman Digna defeated by Sir G. Graham with an English force.	S.
"	TOFRIK.	"	" 22	Osman Digna again defeated. Sir J. McNeill's Zariba broken.	"
"	Tamai.	"	Apr. 3	Occupied by British troops. Village burnt.	"
"	T'Hakul.	"	May 6	Enemy dispersed. Lord Wolseley at Sawakin.	"
258	Amadi.	"	Feb. 14	Successful sortie.	E.P.
"	"	"	" —	Fall of Amadi. Garrison cut their way out.	
244	Amadib Senhit.	"	Mar. —	Withdrawal of garrisons.	A.F.
262	Lado.	"	Apr. 24	Emin Bey leaves for Goudokoro. Siege continues.	E.P.
261	Makaraka.	"	" —	Withdrawal of garrison.	"
238	Sennar and Hessab.	"	Apr. & July	Sorties from Sennar by Hassan Sadik and Nur Bey.	A.F.
268	Dongola.	"	June 15	Evacuation of Dongola.	N.
248	Kassala.	"	" 15	Attack repulsed and successful sortie made.	A.F.
228	"	"	" 22	Death of the Mahdi.	
249	"	"	" 30	Surrendered to Wad Hushi.	A.F.
252	Gera.	"	July —	Withdrawal of garrison.	"
"	Jebel Dair.	"	" —	Mek Kumbo besieged by Abu Angar.	K.
238	Sennar.	"	Aug. 18	Fall of Sennar.	B.N.
251	KUFIT.	"	Sept. 23	Osman Digna defeated by Ras Alula. 3000 Arabs and 1500 Abyssinians killed.	A.F.
264	Bohr.	"	" —	Garrison slaughtered.	E.P.
"	Lado.	"	Oct. 4	Attack repulsed; siege continued.	"
272	Ambigol Wells.	"	Dec. 2	Attack repulsed by British troops.	N.
273	Mograkeh Fort.	"	" 12	Siwari ed Dahab repulsed by Captain Besant.	"
291	Khor Telodi.	"	" —	Attack by local tribes upon Abu Angar's position driven off with great slaughter. 10,000 said to have been killed.	K.
256	EN NIMA.	"	" 20	Sherif Mahmud Abdel Kader defeated by old Egyptian troops from Obeid. Abu Angar subsequently dispersed them.	"
277	GINNIS.	"	" 30	Sir F. Stephenson's victory with British and Egyptian troops over Abdel Mejid.	N.
258	Ed Dijan.	"	—	Madibbo defeated by Karamallah and Arab force.	D.
297	Arbaat.	1886	—	60 miles north of Sawakin. Defeat of Saadun by the Amarar.	S.
292	Darra.	"	—	Madibbo defeated by Karamallah and afterwards beheaded.	D.
300	Tamai.	"	Oct. 7	Retaken by the Amarar.	S.
321	Abka Pass.	"	" 25	Colonel Wodehouse's successful skirmish.	N.
339	Om Badr.	1887	Feb. —	Saleh, of the Kabbabish, defeated by Emir Hamad and killed.	K.
324	FRONTIER OF DARFUR.	"	May —	WAD ALIM with 500 men utterly destroyed by Jarut and Sultan Yussef's men.	D.
316	SARRAS.	"	Apr. 28	Nur el Kanzi defeated by Colonel Chermside with Egyptian troops.	N.
324	Et Towaish.	"	June 2	4000 men under Abu Dembo massacred Emir Hassan Agha and 500 men sent by Karamallah.	D.
325	"	"	" 29	KETENBUR with 2000 of Karamallah's men utterly defeated by Tayid of Jebel Marra.	"
333	Debra Sin.	"	Nov. —	Abyssinians under Ras Adal defeated by Abu Angar.	A.F.
334	Gondar.	"	—	Sacked by Abu Angar.	"
342	Sawakin.	"	Dec. 16	Besieged by Osman Digna.	S.
343	Dara.	"	" —	Osman Digna's men defeated by the Amarar.	"
325	Khumma.	"	" 26	Osman Adam and Karamallah dispersed the Darfur forces.	D.
337	Karkoj.	"	—	Rufaa tribe defeated by Yunis ED Dekeim. El Merhdi killed.	A.F.
343	Taroi.	"	—	Osman Digna's camp captured by the Amarar.	S.
348	Handub.	1888	Jan. 17	Colonel Kitchener's attack upon Osman Digna, who was nearly captured.	S.
353	Dara.	"	" 17	Amarar defeated, losing 700 men.	"

Page.	Names.	Year.	Date.	Description.	Guide to locality.
345	Kalabsheh.	1888	Feb. 26	Dervishes driven out by Captain Besant.	N.
356	Fort Shaata.	"	Mar. 4	Major Shakespear's attempt to dislodge rebels. Major Tapp killed.	S.
398	Messa.	"	June 3	Mustafa Gibran with Ababdehs and Kisharin defeated 250 men under Emir Giderri.	N.
348	Dabrosa.	"	July 19	Raided by 500 horsemen.	"
371	Galabat.	"	July or Aug.	Abu Angar defeated by the Abyssinians. Subsequent death of Abu Angar.	A.F.
359	Sawakin.	"	Sept. 17	Siege renewed.	S.
378	Kebkebieh.	"	Oct. 16	Abu Gemaizeh's victory over Osman Adam. Siege of El Fasher.	D.
365	GEMAIZEH.	"	Dec. 20	Capture of position by Sir F. Grenfell with British and Egyptian troops.	S.
439	Galabat.	1889	Feb. 9	Abyssinian victory over Nur Angara. Death of King John and flight of Abyssinian troops in consequence.	A.F.
456	El Fasher.	"	" 22	Osman Adam defeated Abu Gemaizeh, who died next day.	D.
439	Galabat or Atbara River.	"	Mar. 12	Abyssinians retreating from Galabat routed by Wad Ibrahim. King John's body captured.	A.F.
405	Argin.	"	July 2	Colonel Wodehouse defeated dervish invading force. 900 men killed.	N.
425	TOSKI.	"	Aug. 3	Wad en Nejumi's force utterly defeated by Sir F. Grenfell. Wad en Nejumi killed, and 1200 Arabs. 4000 prisoners taken.	"
492	TOKAR.	1891	Feb. 19	Recaptured by Colonel Holled Smith with Egyptian troops. 700 rebels killed. Osman Digna escaped.	S.
507	Afafit.	"	" 23	Occupied by Egyptian troops.	
—	Fashoda.	"	—	Taken by Teki Sumal from Shillaks.	E.P.
—	Regaf.	"	—	Taken by Omar Saleh.	"
—	El Fasher.	"	Apr. June.	Evacuated by Mahmud Ahmed, who eventually withdrew to EL OBEID; the whole of Darfur thus evacuated.	D.

N. = Nile.
W.N. = White Nile.
B.N. = Blue Nile.
K. = Kordofan.
D. = Darfur.
E.P. = Equatorial Provinces (including Bahr el Ghazal).
A.F. = Abyssinian Frontier.
S. = Sawakin.

The Nos. of pages refer to the book entitled "Mahdiism and the Egyptian Sudan."

FIRE DISCIPLINE AND SKILL-AT-ARMS.

BY

MAJOR P. F. HAMILTON, R.A.

It is impossible to take up the "Proceedings" for September, 1892, and to read the "Silver Medal Prize Essay" and the paper "Skill-at-Arms," by Lieut.-General Sir W. J. Williams, K.C.B., without being struck with the thought that as the authors are so much at variance in their recommendations there is a danger to be feared if officers of the Regiment allow themselves to acquiesce blindly in the theories advanced by either author to the exclusion of those of the other. It would almost appear as if the author of "Skill-at-Arms" had read Captain White's lecture before writing his paper (which I presume was impossible), and had at once sat down and displeased with the, in his opinion, "irrational changes" attempted to be introduced, had set himself to demolish, one by one, in order, the constituent parts of "Fire Discipline," as enumerated under the headings in the body of the essay.

We know, however, that the paper "Skill-at-Arms" is directed, not only against the recommendations contained in either the Gold or Silver Medal Prize Essay, but is also a direct challenge to those who, in virtue of their position, or who, in obedience to recent instructions and orders on the subject, are now endeavouring to perfect the very much improved shooting of the Field Artillery. It is for this reason that I apprehend the real danger that will exist if Regimental Officers (by whom I mean those who will actually have to solve the problem in case of war) cannot satisfy themselves that what is being done is the best that can be done, and that all regulations, instructions and drills will be framed so as to ensure the best results.

My object then, in writing to the "Proceedings," is not to venture to criticise either the Prize Essays or "Skill-at-Arms." I would instead, try and reconcile the various excellent suggestions made by the authors, with the humble hope that those in authority may see their way to issue such modified instructions as will tend to remove the impression now existing among many Field Artillery Officers, that the present method of proceeding is unsatisfactory.

In the first place, we must all be agreed that our shooting is improving, and that there is room for very much more improvement, and that such improvement is necessary.

It seems idle to argue with those who say that we did very well in years gone by, and that we shall get on very well without the elaborate drill, care and training that our officers and men now receive.

I make two statements which appear to me to comprise the recommendations of the authors of "Skill-at-Arms" and of the "Silver Medal Prize Essay":—

(1). That the question of handling artillery, and of the personal

commanding and leading of the Brigade Division is of more importance than ever.

(2.) That the power of striking the enemy the most powerful blow possible is of paramount importance, and that Rapidity of Movement, Fire Power, and Fire Discipline combined will achieve this object.

I take the first of these statements. I do not think the question admits of argument. It is generally agreed to; but it cannot help occurring to the Regimental Officer that he never has an opportunity, under the rank of Lieut.-Colonel, of handling a Brigade Division, except possibly at Aldershot, or at a practice camp in India. By handling I do not mean the putting the Brigade Division through the half-dozen movements left us in the Drill-Book, I mean it as General Sir W. Williams means it. I mean the personal command and leading of it. If there was constant practice to be had in leading a Brigade Division, I believe it would be quite possible in time, for an officer to lead his command personally into position and open fire, without any of the tedious delays complained of by General Sir W. Williams. I am as strongly opposed as he is to bringing up the Brigade Division into position in the way one is now supposed to do. In fact, I think it would be impossible on service and, possible or impossible, I feel sure it would not be so done, for it is as he terms it "unwarlike." At the same time I consider the present system has had its uses, but that these aids to handling, to careful driving, and to movement must now disappear from the Drill-Book. The system has shewn us how necessary it is to bring guns, at full interval, square up to the position to be occupied. Great attention and instruction is given to our gunners. Equal care must be taken with our drivers who, when they know what is expected of them, will do as well as they generally have done. In the same way, our Nos. 1 require more training in leading their sub-divisions. Constant practice, long advances in line, and practice in changing direction would give the leader and his command confidence.

The tedious delays referred to above are caused by:

1. Halting in the preparatory position.
2. Reconnoitring by the Commander.
3. Marking the position of the batteries and even of the guns by their layers.
4. Pointing out the target.
5. Taking the range.

I consider the training we have received in the last few years, with reference to 1, 2, 3 and 4, has been invaluable, that the time has come when such operations should disappear as a drill, as they are now unnecessary, with the exception of what one might call the preparatory halt for the purpose of loading. It will be well if arrangements can be made to carry two fuzed shrapnel on the gun carriage.

As regards reconnoitring, whatever is necessary must be done when the batteries are on the move.

The marking the windward flanks of the batteries by Battery Commanders, the calling forward of Section Officers and gun-layers, and the exact placing of the latter, as recommended by Captain White in the "Silver Medal Prize Essay," under the heading "Pointing out

the Objective," are all matters which have been severely criticised, and not without reason. If opportunity to do so occurs, and time permits of such operations, I agree with Captain White that so obvious an advantage should not be neglected, but to lay down such methods as the normal drill is, I submit, a great error.

However well such a drill may answer against dummies at a practice camp, it would rarely be possible on service, and the objections to it are so obvious and so numerous that I refrain from mentioning more than two principal ones, though there are others nearly as strong :—

1. The great loss of time.
2. The unavoidable exposure, for a considerable time, of the most valuable officers and men, the loss of whom means that probably the position will never be occupied.

The first of these objections speaks for itself, and, in case I am accused of putting the second too strongly, I can only say I advance it from what I have seen, not on service, but at practice camps. We are told, over and over again, that this method of taking up a position can be and must be done without unduly exposing the Brigade Division Commander, the Majors, the Section Commanders, the Gun-layers, to say nothing of the Range-takers, the Trumpeters, the orderlies and horse-holders, but I must say I have never seen it so done, nor do I believe, if this drill is persisted in, that the first indication of the presence of our guns will be, as it ought to be, by the opening of their fire. Whatever our target may be on service, it will, as often as not, be formed of troops armed with modern weapons of precision possibly at long range, but not necessarily so, and we may rest assured that an enterprising enemy acquainted, as they soon will be, with our method of proceeding will be careful to take full advantage of our mistakes, and if the guns do reach the desired position, a large number of officers and of men difficult to replace will be *hors de combat*.

I believe that on service hardly a case will occur in which the target requires pointing out.

As regards range-taking, I would merely say it is valuable as a guide to open fire, and almost a necessity for very quickly determining a range ; but that as a rule it need not interfere with the advance into position, and it must not be allowed to do so. Ranging should be done by batteries, and I do not believe in a battery remaining under fire without opening fire itself.

The practice, therefore, of the few last years has been useful as a training in slow time for really service practice. Is there any reason why Brigade Division practice should not, next year, be carried out in quick time? It is, I believe, attempted in India where the country lends itself to practice under service conditions. This country, unfortunately, does not, and the only solution I see to the difficulty of getting practice in personally commanding and leading a Brigade Division, is that every year Majors of Horse and Field Batteries desirous of doing so should have command, in turn, of a Brigade Division at Aldershot, under the Lieut.-Colonel Commanding the said Brigade Division. If this could be arranged I am sure most Majors would gladly avail themselves of such an opportunity, and the experience gained would be of great value. A uniform system of handling a com-

mand would also be ensured.

Having considered the question of moving into position, let us look for a moment at the second of my statements. We want now to strike the blow. Fire is to commence within something less than a minute of the trails touching the ground. Distribution of fire commences with the opening of fire. The only necessary commands would be the range at which to open and the rate of fire. The batteries will be fought by their own commanders. At the same time there is an expression creeping into essays and instructions which does not tend to higher Fire Discipline or to discipline of any sort. The word "interfere," when it refers to the action of a Commanding Officer, be he a Brigade Division or a Battery Commander, ought to be expunged from all printed matter. The only man who should not be interfered with is the officer in command.

I do not intend to more than touch on the subject of Fire Discipline. It has been ably treated by the authors of the "Gold" and "Silver Medal Prize Essays." Those who cry down the necessity of further efforts in promoting it would have us believe that it always existed in some form or other. That has not been the experience of most Battery Commanders of the present day who, after all, are the best judges, for they see what it is now and remember it had no existence when they were subalterns. At the same time I venture to suggest that it is not advisable to attempt to lay down a drill for Fire Discipline. All originality ought not to be sapped. Battery Commanders ought to have a free hand as regards working by signal or using their voice, as long as orders are rapidly and correctly passed on. Any successful plan for improving Fire Discipline would be generally adopted. The "Proceedings" of the R.A. Institution affords a ready means of making known any such plans, and there are, no doubt, many excellent schemes which have never been divulged, for the reason that they would not agree with the Drill-Book or instructions for practice. There are many who think marks for Fire Discipline should disappear altogether at the competitive practice. I am at a loss to know why they should be given at all. The faults for which deductions are made surely carry with them sufficient penalty, and naturally Battery Commanders fight shy of trying anything not laid down, for the simple reason that probably points would be deducted.

In conclusion I venture to predict that in the next two years we shall see the Brigade Division led into position by its own commander, in a way that would please the author of "Skill-at-Arms," that its practice, when in position, will be far in advance of anything yet attained, and that we shall have freed ourselves for ever from all the many preliminary operations now considered necessary before moving guns into position. The better drilled and better handled artillery will, in the future, as it has in the past, have an enormous advantage over its antagonist; and it is becoming more apparent every year that we may safely trust to the intelligence, zeal, and devotion of our officers and gunners when once in position to keep up the reputation of the Field Artillery as far as shooting is concerned.

EXETER,
30th September, 1892.

AN INFANTRY OFFICER'S IDEAS ON OKEHAMPTON.

COMMUNICATED BY

THE SECRETARY.

I HAVE been requested to write down for the R.A.I. "Proceedings" the views and ideas I have gleaned during the recent "Senior Officers' Course of Instruction" at Okehampton. I approach the subject with great diffidence, and I beseech my readers to bear in mind, that what I say is not criticism in the proper sense of the term, for in order to criticise one should be thoroughly acquainted with one's subject, whereas I am but a poor ignorant Infantry Officer, who has been taught a smattering of the gunner's science at Shoeburyness and Okehampton; one, well aware that "a little knowledge is a dangerous thing," and by no means anxious to push forward his views, which may very possibly be incorrect ones. Reminding you then that I write at the request of Artillery Officers, and not of my own desire, I will on without further apology.

It would seem that by far the most important operation of artillery in action is finding the range of its enemy. Unless this is successfully done the fire is useless, or nearly so, for if the sights are raised to the wrong amount a destructive shell certainly partakes of the nature of a fluke.

Next in importance is the puzzlement or deception of the enemy while he is endeavouring to range his batteries.

I observed that the men entrusted with range-finders were extremely rapid and accurate at their work, but I have known range-finding N.-C.O.'s in my own branch of the service, who are so well acquainted with the ground they are working on, that they are aware of the distance of most of the objects they are observing, and give the correct range whether their instrument makes it so or no. The ground over which the artillery practice at Okehampton is limited in extent, and it may be that the distance of the targets at the various exercises are more or less known by the gunners before they come on the ground. The question therefore strikes me "Are the human range-finders thoroughly exercised in their art in unknown country at other times of the year than when undergoing their annual course?" It would be easy to test them by chaining a long base and making the men observe prominent objects from either end of it, while an officer checked their observations by means of a theodolite, finding the correct distance by construction or by calculation.

The range having been taken, the remainder of the work, whether in battery or brigade practice, is entirely in the hands of the Major. This officer is the most exposed to the enemy's fire of anyone in the battery except perhaps the range-finders. Suppose he is shot with his important subordinates before the action has in reality commenced. Can the Captain fight the battery? Does he ever get any practice in doing so? I should have liked to have seen the group of soldiers headed by their C.O., who first ride out under fire, all put out of action once or twice, in order to see how the battery would carry on under those circumstances. I am well aware that there are "waiting" layers for each gun, but laying is surely much more easily taught than ranging. "Are there waiting range-finders, and are the Captain and senior Subaltern really useful waiting commanding officers?"

The first shot fired is the most important one in the action. The correct observation of it seems to be most essential to success. If it is a minus, for instance, and falls into a small depression in the ground, so that the rising smoke from the projectile becomes thin by the time it has risen to the level of the target, it may be, and sometimes is, reckoned as a plus. The sights for the next shot are therefore lowered instead of being raised, with the result of another minus. An attempt to bracket on the observations made on these two rounds causes more minus results, and thus many shots are wasted in creeping up to the target, though, no douht, if the battery be long in action the correct range is found at last.

On August 8th, a target at Okehampton was under the fire of a battery for 12 minutes 56 seconds, at a range of about 3000 yards, which did not receive a single hit, and two days later a line of dummies, at about 2000 yards distance, was hit twice in 7 minutes 15 seconds.

Could not the major be assisted in the observation of his first round or two by a sort of committee, consisting say of a lynx-eyed subaltern and an experienced old N.-C.O.?

I conclude that when several batteries are brigaded, any one which fails at first to find the target, is allowed to get the range from a more successful neighbour.

The difficulty of ranging on an enemy approaching is enormous. The system in vogue seems the best possible, but I imagine the calculations of the commanding officer might easily be upset by a crafty enemy. Indeed, I think and hope I have learned useful lessons from Okehampton and Shoeburyness, in the art of leading my own arm of the service to the attack of guns.

As regards defence from an enemy's fire, I am of opinion that cover for the guns and their detachments sinks into comparative insignificance with the importance of preventing the foe from accurately ranging. Surely, if the epaulments and gun-pits, recommended by the text-books on field fortification were used, the newly-turned earth would be a most fatal mark for the enemy to get his range by. It is most difficult to judge at long distances how far one object is in front of another, and even to notice whether two points are or are not in the same parallel line to your own position. It would seem then, as pointed out to me by my instructor at Okehampton, that if the shape of the ground permits of it, a more useful defence for a line of guns would be

a bank, running in an irregular or curving line, some 200 or 300 yards in front of the batteries, which would, I think, cause the hostile guns to range on it instead of on the artillery in rear.

I do not at all mean by these remarks that cover should not be sought for; on the contrary, a line of guns is a tremendous target when in the open, and would, in my opinion, be in great danger even from infantry volleys at 1800 yards or so. Cover from view, however, would I think, be almost as useful as cover from penetration, and I should like to see some sort of light screen carried, which could be hidden with heather, gorse, or whatever vegetation would give it the same colour as its surroundings.

I was filled with admiration by the rapidity and accuracy of the movements of Field Artillery in taking up and changing their positions, though I have seen a good many field-days at Aldershot and elsewhere, but I should have liked to have seen a battery or brigade suddenly attacked in flank in order to have watched it wheel up to resist the sudden onslaught.

On August 15th, while in action against infantry, each battery at Okehampton was in turn attacked by cavalry, and they turned their fire upon the new danger with great smartness, but the attack was delivered from a direction almost in the front of the battery, and it was unnecessary to move any of the guns from their position. Now, I can conceive a case of a battery or brigade having, perhaps only temporarily, one flank undefended during an action, and the enemy's cavalry seizing the opportunity of attacking it there, and I confess I should like to have seen the action of the artillery in the case I have suggested.

The more practice I saw at positions occupied by dummies the more I was convinced of the desirability, nay, the necessity, of the guns following their friendly infantry into the fight as they advance. On August 19th, a position was occupied by a dummy army, and attacked by a combined force of artillery and infantry. The dummy General had occupied advanced posts some 700 yards in front of each flank of his main position, and from the point where the guns first opened fire, these advanced posts appeared to be almost in line with their friends in rear. If the position had been occupied by flesh-and-blood soldiers, and if our guns had not advanced as they did when these posts fell into the possession of our men, nothing but a marked difference in the colour of the uniforms could have prevented our gunners mistaking their own infantry for the enemy and opening fire upon them.

I will conclude my remarks by mentioning one more point which it was impossible not to notice during both the recent courses I have attended, and particularly at Okehampton. I allude to the extraordinary zeal and keenness for their business evinced by all ranks of the Royal Artillery, from Field Officers to private men. I am proud to think, that zeal for the efficiency and improvement of their arm is not the monopoly of the gunners, but I am certain it is shown by them to a very remarkable degree.

CHATHAM,
21st August, 1892.

A NOTE ON
THE GOLD MEDAL PRIZE ESSAY, 1892.

BY

LIEUT.-COLONEL J. F. BROUGH, R.H.A.

Having read Major A. M. Murray's very able Prize Essay, I hope I may be permitted to offer a few remarks, in the nature of suggestions thereon.

In Part III. a programme is outlined for the annual training of every battery on the following lines :—

1st Week.—Sub-divisional drill.

2nd Week.—Section drill.

3rd Week.—Instruction in the gun park under the Battery Commander.

4th Week.—Instruction of the battery in the field under the Battery Commander.

5th and 6th Week.—Combined manœuvres of batteries under their Lieut.-Colonel.

The programme is a sound one no doubt. But Major Murray lays down, and I think most will agree with him, that to enable batteries to properly carry out such a course, each battery should be taken off regimental and garrison duties in turn.

Now, if the course is commenced on the 15th March, how does he propose to have all batteries completed in it by, say, the middle of May ?

The 1st Division Field Artillery Course at Okehampton began on the 14th May this year.

Supposing three batteries to constitute the Lieut.-Colonel's command, and the separate course of each to occupy one month, and the combined manœuvres under the Lieut.-Colonel to occupy two weeks, then, commencing on the 15th March :—

The 1st Battery would finish on the 15th April.
The 2nd „ „ „ „ 15th May.
The 3rd „ „ „ „ 15th June.
The combined manœuvres „ „ 1st July.

Simple, therefore, as Major Murray's proposal may seem, and gladly

enough as would we all hail the possibility of its being carried out, I do not see how this could be accomplished except under exceptionally favourable local circumstances.

Now, on the other hand, let us assume that an order be issued that "the battery should be ready for the practice ground" by the 1st May annually: this would leave a fortnight's margin for the march to Okehampton, &c.

Next, on this assumption, how are we going to fit in the annual course of each battery of a three-battery Brigade Division, so as to allow the battery courses, including the combined manœuvres under the Lieut.-Colonel, to be completed by the 1st May?

From the 15th March to the 1st May is only six weeks. It is manifestly impossible then to squeeze the course, proposed by Major Murray, for three batteries, occupying as it would (as already shown) three-and-a-half months, into those six weeks.

Can we curtail any of the proposed course? Would not half of the fortnight allotted for the combined manœuvres under the Lieut.-Colonel suffice? One working week, that is, five days of daily combined manœuvres ought surely to be sufficient to freshen up batteries of any ordinary standard.

This would leave five weeks, or say 36 days, for the courses of the three batteries; or 12 days for each battery. Which 12 days, I am sure, every Battery Commander would find none too many for his own portion of the course. Where only two batteries were concerned, each would have 18 days. But I prefer to endeavour to show what might be done for the larger command.

Now this necessitates the omission of the "Sub-divisional Drill" and the "Section Drill," *unless* the Battery Commander can arrange that these preliminary portions of the course be carried out before the actual drill season opens. And I do not doubt that Battery Commanders could and would arrange so that this would be done.

"A connected course of instruction extending throughout the year," to use Major Murray's own words, ought in itself to ensure the training he contemplates as "Sub-divisional" and "Sectional" being carried out.

Standing gun drill, fuze drill, and laying, would naturally form the chief features of such a connected course, together with instruction as to the sights. Whilst the "mechanical precision," which he alludes to under "Sub-divisional drill," can hardly be expected to result from one week's extra such drill; but must rather be looked for as the outcome of a "connected" system from year's end to year's end.

If Battery Commanders, when they drill their batteries, accept Lord Roberts' dictum, namely:—

(1.) At every drill parade of the battery one or more positions should be taken up for coming into action under service conditions with regard not only to the selection of the positions and the manœuvring of the battery up to them, but the *carrying out of every detail.*

(2.) Shells and cartridges should be brought up to the guns.

(3.) Fuzes prepared.

(4.) Guns accurately laid at an assigned object of which the range has been determined.

Then they would be carrying out a "connected course of instruction extending throughout the year," and every detail which a battery would be called upon to perform in front of an enemy would become "second nature" to it, from the Battery Commander to the least accomplished No. 9.

REPLY,

BY

MAJOR A. M. MURRAY, R.A.

By the favour of the Secretary of the Royal Artillery Institution I have been allowed to see Colonel Brough's paper before publication, so that any remarks which might seem useful in the nature of a reply could appear simultaneously with the criticism.

I gather from Colonel Brough's paper that he thinks the programme laid down in Part III. of the Gold Medal Prize Essay is "sound," and can be carried out at stations where there are only one or two batteries, but that at larger stations where three batteries constitute the Lieut.-Colonel's command, and where all three may have to be ready for practice by the 1st of May, there would not be sufficient time for each battery, turn by turn, to go through the proposed course.

Colonel Brough proposes, therefore, to curtail the course by cutting out the two weeks allotted to sub-division and section instruction, and one of the two weeks laid down as necessary for the Brigade-Division Commander. He would then divide the time[1] from the 15th of March to the 1st of May between the Battery Commanders and the Lieut.-Colonel, limiting the share of the latter to one week. Colonel Brough's suggestion is that the "preliminary" part of the course—viz., the sub-division and section drills—could be carried out before the drill season begins, and that "one working week" under the Lieut.-Colonel ought to be sufficient to "freshen up" batteries of "ordinary standard."

Having been invited to submit a reply I would ask leave of the Committee to do so as follows. The periods of time laid down in the Essay for sub-division, section, battery, and brigade-division drills were minimum periods. No lesser periods under the new conditions of Fire Discipline training will, it is thought, suffice; and the writer is confident that every Commanding Officer responsible for the successful shooting of his battery at next year's practice will endorse this

[1] Colonel Brough calculates upon each Battery Commander getting 12 days; but this calculation seems to include Saturdays and Sundays. In five weeks there are practically only 25 working days, as Saturdays must be given up for other purposes than instruction. This would give little more than eight days to each battery.

opinion. If possible, the time should be extended rather than curtailed. The sub-division and section instruction, as sketched out in the Essay, is not a "preliminary"[1] but an integral part of the battery course, which is based on a definite and progressive programme drawn up by the Battery Commander, and which recognises the principle that each sub-unit—the sub-division, then the section—must be first perfectly trained under its own immediate head before the whole unit can be collectively trained under the battery leader. Unless this is done the Commanding Officer will begin his own work with an imperfectly constructed machine. The instruction cannot be given before the drill season begins, for it is essential that it should be uniformly and simultaneously carried on by each sub-unit commander under the direct personal supervision of the battery leader acting in his capacity as chief instructor. This can only be the case when the whole of the officers, N.-C. officers and men—each with his "understudy," as Major Davidson has so expressively put it—are in the appointed places which they will occupy at the subsequent practice and manœuvres, and if need be on active service.

Not less direct must the reply be to the proposal to cut off one of the weeks allotted to the Brigade-Division Commander. Those who have had the advantage of being present at Sir Evelyn Wood's artillery tactical days at Aldershot know the difficulties of manœuring three batteries under service conditions. To manœuvre three battalions of infantry or three regiments of cavalry is generally admitted to be an easier task. Artillery tactics are subject to constant modification. The drill-book is only a guide for the current year. At the beginning of each season new "instructions" are issued based on the experience gained during the previous year. What is required is something more than mere "freshening up." So soon as the batteries are thoroughly trained under their own commanders it becomes the function of the Brigade-Division Commander to practice his batteries in manœuvre tactics, so that each may be trained to work "simultaneously but independently" under his own instructions. Until this is done the training of the Battery Commanders in Fire Discipline cannot be said to be complete, nor are the batteries ready for the practice ground, or for combined manœuvres. Is a fortnight[2] too much for this work? I do not think any Lieut.-Colonel now in command of a brigade-division at Aldershot would say that it was.

Keeping, then, strictly to the lines of the Essay, which was written after two years' practical experience of the command of a battery at Aldershot, and accepting Colonel Brough's condition that the batteries must be ready to march by the 1st of May, the proposal in this case is to strike all three batteries simultaneously off regimental and gar-

[1] "Preliminary" instruction can be given in the winter to young officers, N.-C. officers, and recruits, so that they may be ready to take their appointed places when the annual course begins. When, however, the course is started the adjective "preliminary" ceases to apply.

[2] Colonel Brough speaks of five days manœuvring in the "working week;" but is not this working at higher pressure than batteries are capable of so early in the year? Three days manœuvring in the week is normally as much as can be expected having regard to the necessities of turn-out and the condition of the horses. At combined manœuvres later on in the year it is possible to work at higher pressure.

rison [1] parades from the 15th of March to the 15th of April, and off all garrison parades from the 15th of April to the 1st of May. It was not so much a programme as a system which was in the writer's mind in submitting his proposals in the Essay. Each Battery Commander works out his own programme, but what seems essential is that at the beginning of each drill year as soon as the furlough season is over, and not till then, his battery should be placed absolutely and undividedly at his own disposal for a period of one month, during which time there should be no calls made on it for reviews, field days, inspections, or other work by any superior officer. It is further proposed on the lines laid down in the Essay that at the end of the month the Brigade-Division Commander should have his three batteries equally at his unrestricted disposal for a period of a fortnight.

These six weeks of preparatory instruction form the first part of that "connected course of instruction extending throughout the year" referred to in the Essay, and which has been made the subject of comment by Colonel Brough. What should follow afterwards is not now in question.

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[1] What interferes with systematic battery instruction at the beginning of the drill season are superior parades requiring previous preparation which breaks in on current work. The employments do not constitute a serious difficulty. The proportion of employed men who are not available for the annual course is small. They are generally old gunners who would not be taken for the practice, and who, if necessary, could be temporarily relieved by drivers. One N.-C. officer and three gunners would have to be found for the regimental guard once in three days by each battery in turn, but with this exception the whole of the N.-C. officers and men could be in their places.

ACHIEVEMENTS OF FIELD ARTILLERY.

BY

MAJOR E. S. MAY, R.A.

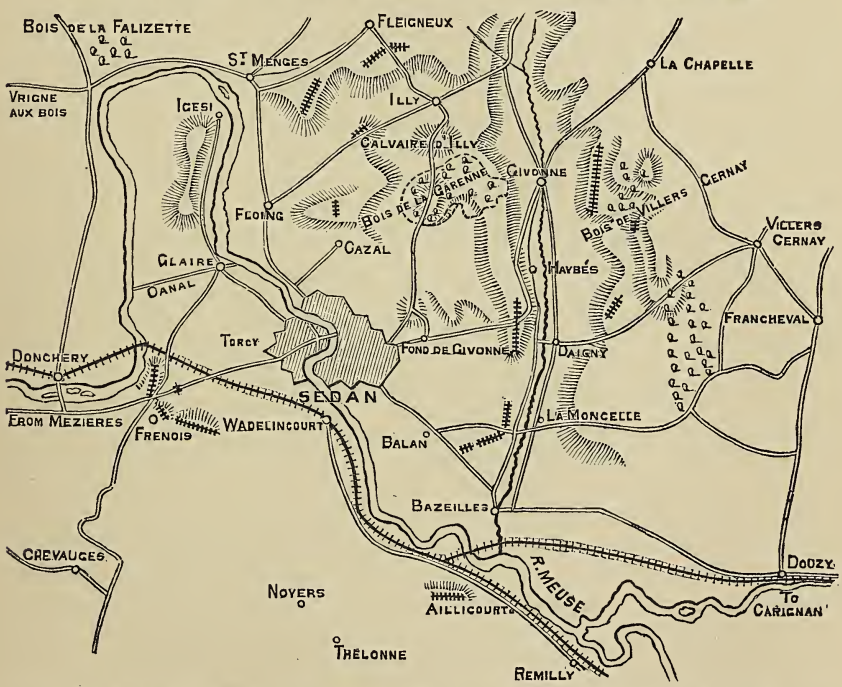
PART V.[1]

It was at Sedan, however, on the first of the following September, that the German artillery gave the most signal proof of its efficiency and destructive effect, and that decisive blow has been termed "the greatest artillery battle of the war."

On the 31st August the army of MacMahon, foiled in its flank march to the relief of Bazaine, stood at bay in a curved line round the little fortress of Sedan, while the German armies, under the Crown Princes of Saxony and Prussia, advancing from the east and south, threatened to crush it between them, or force it over the neutral Belgian frontier in dangerous proximity behind. One French corps (the 7th) faced

BATTLE OF SEDAN.—September 1st, 1870.

General position of German Artillery shortly before the end of the struggle.



north-west on the Illy plateau. Two corps (the 1st and 12th) con-

[1] Not Part IV., Chapter II., as originally intended.

tinued the line through Givonne, Moncelle, and Balan to Bazeilles, and the 5th Corps, much shattered at Beaumont, was in reserve. The high ground on the west of the Meuse was sufficiently near the old-fashioned little fortress to enable rifled artillery to bombard it from thence. No attempt was made by the French to occupy the left bank of the river, nor were the bridges at Donchery or opposite Bazeilles destroyed. Large masses of guns were, therefore, easily placed by the Germans in position east of Frenois, the 11th Corps of the 3rd Army was sent across the Meuse at Donchery to attack the enemy entrenched near Floing, and the 5th Corps was to bear down on them at Illy.

The 1st Bavarian Corps was to assault Bazeilles, the 2nd Bavarian Corps remaining on the left bank of the river to guard the rear, and the Wurtemberg Division was placed across the road to Mezieres, shutting off retreat in that direction.

The French position along the deep valley of the Givonne was extremely strong, and was to be assailed by the "Army of the Meuse," under the Crown Prince of Saxony, of which the 12th Corps advanced between Moncelle and Daigny, the Guard assaulted Givonne, while the 4th Corps, which came up late in the day, supported the three corps thus already pressing the eastern side of the French positions.

At 4 o'clock, through the thick mist of an autumn morning, the Bavarians commenced the attack by crossing the pontoon bridges, which had been fixed near Aillicourt the previous day, and advancing towards Bazeilles, where a furious conflict was commenced which raged with varying success round and in the village for the next six hours. The guns of the 1st Bavarian Corps could not effectively support this advance at first, on account of the heavy mist, and in order to reach the streets of the village were brought across at about 9 o'clock. The artillery of the 2nd Bavarian Corps was placed on the heights near Frenois to prevent any attempt at escape along the Mezieres road on the western side of the Sedan.

At 5 o'clock the Crown Prince of Saxony had pushed forward an advanced guard of 7 battalions from Douzy in the direction of La Moncelle, with which the Saxon artillery was sent ahead boldly, and gradually a long artillery line was built up south of Daigny on the eastern slopes of the Givonne Valley, which shortly after 9 o'clock consisted of 13 Saxon and 3 Bavarian batteries.

La Moncelle fell into the hands of the Germans between 6 and 7 o'clock, and, after the most obstinate resistance, Daigny and the bridge over the Givonne were captured three hours later. Meanwhile, on the French side, Marshal MacMahon had been wounded and obliged to leave the field at 6 o'clock, and had handed over the command to General Ducrôt. That officer set about retreating to Mezieres, but being superseded almost at once by General Wimpfen, a totally different policy was pursued, and an effort to break through and reach Carignan was set on foot. At 10 o'clock this attempt had, however, been foiled, and, as we have seen, the Germans were left in possession of the passes across the Givonne.

While the French efforts on the east of Sedan had thus proved in vain, the retreat to Mezieres had also been cut off by the 5th and 11th

Corps of the 3rd Army and the Wurtemberg Division. These troops had crossed the Meuse at Donchery, and by pontoon bridges a little further down the river, by 6 o'clock. The two corps marched to the right towards St. Menges, while the Wurtemberg Division remained to block the road westwards. The advanced guard of the troops moving north was directed next on Fleigneux, to cut the French off from the Belgian frontier; its leading troops encountered little resistance, and were deployed towards Illy, but then they had to sustain several assaults from their foes, who strove hard to clear a road northwards.

The three first German batteries which arrived near St. Menges came into action to the south-east of that village, and had to make a gallant struggle to maintain themselves against the powerful line of French artillery between Floing and the Calvaire d'Illy, and three guns of one had to be withdrawn out of action.[1] These guns co-operated most efficiently with the infantry in repulsing the charge which the Margueritte cavalry division made upon them at this period of the fight.

But as the time passed reinforcements were approaching, and at 1 o'clock the whole Corps Artillery of the 11th Corps joined the leading guns, and 14 batteries stood in action in one combined mass. To their left the artillery of the 5th Corps were likewise forming up, and thus 24 batteries, subsequently further increased, were throwing their shells into the contracted French position before them.

The cross fire of these batteries, and of the Guard Artillery, which was also coming into action on the high ground east of Givonne, produced an overpowering effect. "The French guns were partly dismounted, partly deprived of their detachments and teams; many ammunition wagons were blown into the air. The troops, already shaken in their steadiness, fled from many points of the line into the Bois de la Garenne."

There is abundant evidence in the official account of the tremendous effect produced by this cross fire, which annihilated every attempt the French infantry made to assume the offensive and recover the spur of Illy, from which they had been driven; and the performances of the Artillery of the Guard under Prince Kraft receive, in the judicial utterances of the German General Staff, as high encomiums as their proud leader lavished on them in his celebrated letters.

The Guard had arrived on the upper Givonne about 10 o'clock, and had completed the German line between the 12th and 5th Corps in the great concentric attack which was holding the French tightly gripped on all sides.

At 2 o'clock 60 of their guns were vigorously co-operating with the artillery of the 3rd Army, and, drawn up in one great battery opposite Givonne, were searching the wood of La Garenne with a most effective fire. The five other batteries of the Guard were posted further to the south, and with seven of the Saxon and two Bavarian batteries formed another formidable mass which engaged the French batteries to the west of Daigny. Further to the south, in front of La Moncelle and

[1] Official account. Part I., Vol. II.

Bazeilles, which was now in German hands, the Bavarian and remaining Saxon batteries formed another vast link in the terrible chain which was binding down their gallant opponents.

About 1.30 o'clock the most brilliant but useless effort was again made by Margueritte's cavalry division to force back the German inroad between Cazal and Floing, and relieve the left of the French 7th Corps, which was being "overwhelmed by the shells of the Prussian batteries," but the splendid horse were sacrificed to no purpose, the vigorous flanking fire of the German guns disordered their onset, and after a magnificent display of courage in repeated attacks, the brave cavalry were finally baffled, and sought the shelter of the fortress, leaving half their number strewn upon the field. The French now evacuated Cazal and sought their last stronghold, the Bois de la Garenne.

Meanwhile, however, they had made a final effort to force their way to Carignan, but the orders issued for the purpose had miscarried, and the attempt, supported by an inadequate force, died away under the shells from the guns on the eastern slopes of the Givonne, while the Germans following up their success planted their victorious cannon on the high ground on the west of the stream until, at 3 o'clock, 21 batteries stood in line between Bazeilles and Haybés.

As evening came on a considerable part of the French forces had taken shelter behind the old-fashioned ramparts of Sedan, while another vast section wandered as fugitives over the country between Cazal and Fond de Givonne.

In the Bois de Garenne many corps of all arms had also sought cover and strayed hither and thither, like the lost souls in Hades, in a disorganised state, vainly seeking relief from the remorseless fire of the never silent guns. Large portions of cavalry, which after the unsuccessful charges near Floing, had thrown themselves into the wood with the view of breaking out northwards, or to avoid the thick shower of shells, increased the general confusion. But "an impenetrable rampart of German guns and troops upon the heights of Fleigneux and to the east of the Givonne had for some time past rendered any attempt to break through into Belgian territory impossible. And so annihilating was the fire of the artillery that the French were scarcely capable of any organised resistance, when the German infantry towards 3 p.m. moved forward on all sides against the wood."

Thus speaks the official account, but to tell the story of the fire effect of the artillery in the last scene of the mighty drama, we may call a witness who can testify from a personal knowledge of what occurred.

After a short cannonade the 1st Division of Guards ascended the hills from the Givonne, the Saxons joined the forward movement on their left, while the left wing of the 3rd Army pressed ahead from Illy at the same moment. As the artillery of this 1st division of the Guard emerged from the edge of the wood, Prince Kraft says:[1] "a powerful line of artillery (field guns and mitrailleuses) presented itself to our view at a range from which its fire was very effective. Most of these

[1] 4th Letter on Artillery.

guns were covered by earthen parapets, and they were hurling death and destruction on the Saxons." Even the French guns, we may note in passing, were capable of something more serious than merely moral effect, but they were taken in flank by three of the batteries just specified, and the brilliant effect obtained by the German batteries, and by those of the 12th Corps, was amply vouched for by the number of disabled guns and mitrailleuses found subsequently in the emplacements. Then the enemy tried to bring his artillery into action at a closer range against these batteries of the Guard who were so greatly troubling him.

"A battery horsed entirely with greys trotted up from the Fond de Givonne to Givonne itself, and tried to take up its position between that village and the Bois de la Garenne. As soon as it appeared on the hill the three batteries mentioned above opened fire on it. It fell to pieces, as it were, and its ruins remained where they fell. It did not fire a single shot. A second and a third battery met with a like fate." Then to corroborate what he says (it is still Prince Kraft who is speaking) he brings forward the evidence of his foes from a French pamphlet which appeared after the war, and which contained the following statement :—"The Emperor himself tried to post three batteries at the exit from the low ground of the Givonne. They were demolished without having fired a shot."

But, if it had been destructive before, when the line of guns was increased to 90, the effect was truly terrible. As the troops of the enemy attempted to show themselves the combined fire of this great mass overwhelmed them with "such a hail of missiles that they broke up and fled into the forest where they hoped to find shelter. The spectacle of the carnage worked on these masses of men was horrible : the fearful cries of the victims of our shells reached as far as where we stood."

Instances from this battle of the effect with which the efforts of the German guns were crowned might further be multiplied, but want of space and the fear of wearying our readers with a tale which must be familiar to many of them compels us to pass some over in silence. Otherwise we would show how, even at 4000 yards, their missiles carried destruction with them, and how, in spite of what has been said in these pages, as to artillery not being able to carry off the trophies of its prowess as do the other arms, a whole battery of French guns was found lying helpless in the path of the German guns, a grim tribute to their steadiness of aim.

But we must pass on to the last decisive strokes of the battle, and tell how, when the final onslaught of the Guards was to be delivered, a furious cannonade from the great line of batteries shook the forest. A heavy salvo, about 2.30 o'clock, was the signal for the infantry that the moment for their advance was come, and, starting from the Givonne, they began to swarm up the opposite slope. Let us listen to the leader of those efficient guns once more :—"We were in a state of feverish expectation ; every eye was fixed on the forest. We asked ourselves if the capture of the edge of the wood would cost as many lives as had that of St. Privat. But this time the resistance met with was almost *nil*. At most points the French, utterly discouraged,

advanced to meet our troops, crying 'Mercy! mercy! we can do nothing; we are crushed by the fire of your artillery.' Only in the interior of the forest did they try to fight at certain points, and even there the resistance was not stubborn. Unless I am mistaken, the Guard Corps at this place captured from 11,000 to 14,000 unwounded prisoners. The whole of the infantry of the Corps lost in this battle only 120 officers and 320 men killed and wounded."

Since Prince Kraft was an enthusiastic gunner it may be thought that his testimony may be tinged with partiality, and is to be accepted with caution. Fortunately, however, it may be corroborated by the evidence of those who had no special interest in artillery, and in the first place by an Englishman. The correspondent, who wrote those letters in the *Daily News* which attracted so much admiration more than 20 years ago, was riding over the field the next day and wrote:—"The ghastly wounds inflicted on most of the French dead whom I saw upon the hill, showed that they had fallen under an artillery fire; and the ground was in many places so ploughed up that a blanket could scarcely have been laid on it without covering some spot where a shell had exploded."

We have already quoted the eloquent cry "Mercy! Mercy!" of the French soldiers; it is thus that their leaders have spoken:—Le Brun, commanding the 12th Corps on the right, says[1]—"The troops under my command on this unhappy day did not yield before the enemy, they were crushed by a formidable artillery." Douay, commanding the 7th Corps on the left, reports—"Our adversaries reduced us, so to speak, by their artillery fire alone, for it was only towards the end of the battle, when their guns had crushed and partly disorganised our batteries, our infantry, and our cavalry, that their troops advanced in considerable numbers." Ducrôt, commanding the 1st Corps in the centre, has only the same tale to tell:—"Shells came from all parts of the horizon, and united to destroy our unfortunate troops. The situation so disadvantageous to our artillery, was further aggravated by the numerical superiority and the very great accuracy of the enemy's guns. The French batteries were swept away, and literally pulverised in a few minutes."

Von Moltke, in words to be noted later, has also given his guns full credit, and, lastly, in the often quoted official account, where praise and censure are bestowed with cold impartiality on friend and foe alike, the performances of the German artillery at this battle are thus reviewed:—

"The German artillery in the battle of Sedan produces an especially grand and decisive effect. Only the surprise undertaken during the morning mist towards Bazeilles, as demanded by this sort of attack, is made by the infantry alone; but at all parts of the extensive battlefield the whole strength of the batteries was from the first brought into play. Inserting themselves in the columns of route in a position favourable to early deployment, they hastened forward to the battle-

[1] Quoted in an essay:—"Has the adaptation of the rifle principle to fire-arms diminished the relative importance of Field Artillery," by First Lieutenant W. E. Birkhimer, U.S.A. Vol. XIV., "Proceedings," R.A. Institution.

field *with the advanced parties of the infantry.* The batteries of the 11th and 5th Army Corps, which have to traverse the difficult road defile of the Bois de la Falizette, deploy, trusting mainly to their own strength, in one long line though opposed to the hostile masses of horse threatening them and with their backs to the Belgian frontier. As a general rule the attack of the infantry is deferred until the artillery has produced its full effect. From the Calvaire d'Illy the enemy is almost exclusively driven off by the fire of the guns, whereupon a few companies take possession of this important height without a struggle. The shells bursting thickly in the Bois de la Garenne prepare the attack of the battalions of the Guard, and spare the tremendous losses with which previous victories had been purchased."

The remainder of the battle may briefly be dismissed.

While the Guard and the Saxons carried all before them on the east, the 3rd Army pressed on from the north. A wild turmoil ensued; some of the French resisted gallantly, but others, as we have seen, surrended by thousands at a time. At 5 o'clock the Germans were masters of the fortress; negotiations, which ended in the surrender of the Emperor and all his army, had been opened, and the next day 3 standards, 419 field pieces, 139 guns, 66,000 stands of arms, over 1000 baggage and other wagons, and 6000 horses fit for service graced the triumph of the conquerors.[1]

The map of the official account shows some 90 German batteries in action at the close of the day, and 113 on the field, to which the French opposed some 400 pieces, of which 70 were mitrailleuses. The accounts of the numbers engaged vary considerably, but, if we place the French at 120,000, and the Germans at 180,000, we shall probably not be greatly wide of the mark. Of these the victors lost 460 officers, and 8500 men, while their opponents had 17,000 slain, "the work principally of the strong force of the German artillery,"[2] 21,000 were taken prisoners in the course of the action, and 83,000 surrendered at its close.

Those who would do full justice to the German guns, who so largely contributed to such a magnificent success, must bear in mind that the French position, though weak strategically, was tactically strong, and capable of stubborn defence. Moreover, although the Germans were in superior numbers, they were acting against opponents who had the advantage of interior lines, and their force was much disseminated along the wide circumference where it was posted. Finally, let it not be forgotten that their artillery was supported by infantry armed with an inferior rifle, and equipped with common shell alone, accomplished what it did in the teeth of the Chassepôt, a weapon but little, if it was indeed at all, inferior to that with which a large proportion of our infantry were armed only yesterday, and than which the present small-bore has, as a military weapon, still to prove its superiority in the field.

While these mighty events were taking place at Sedan, and the fate of the empire, if not of France, was being determined there, the first

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[1] *See* "The Franco-German War," by Von Moltke.

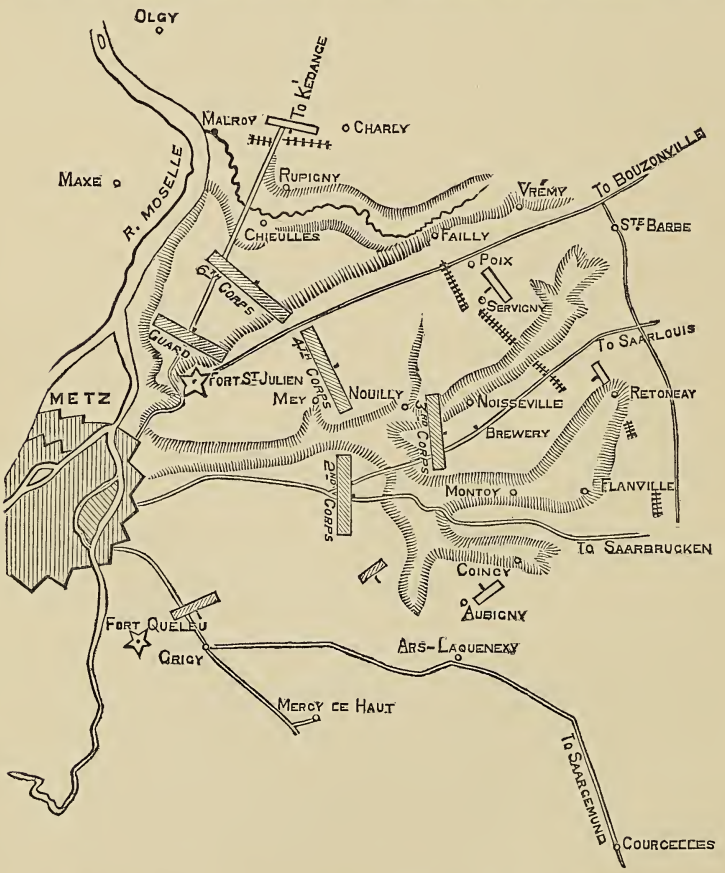
[2] Von Moltke.

and last effort on a large scale of Bazaine to break through the hostile ring which enclosed him was also being foiled. In both engagements the German artillery distinguished itself, but under circumstances widely different.

At Sedan we see the power of its batteries in attack, and their superiority in training and numbers utilised to crush their opponents from a distance, and thus lighten the task of the infantry. At Noisseville, on the other hand, we find the Germans fighting on the defensive against greatly superior odds, and their batteries are found standing proudly alone in front of the infantry and independent of it. They thus receive the first onslaught of the foe, and it is on them that his strength is for a long time spent in vain.

Bazaine's intention was to issue from Metz on the 31st of August with the 4th and 6th Corps between the town of Mey and the Moselle, while of the 3rd Corps one division was to make a feint towards the

BATTLE OF NOISSEVILLE.—31st of August and 1st September, 1870.



south-east, while three assailed Noisseville. The 2nd Corps and the Guard were to form a second line. Thus, at 12 o'clock, five corps would,

it was hoped, attack the positions occupied by only two of the investing divisions, and the weight of numbers might break the hateful chain.

The French arrangements, however, miscarried, the 4th and 6th Corps only reached their rendezvous at 1 o'clock, and then, in place of fighting, set to work to cook their dinners. A few skirmishes which had taken place at Aubigny on the east, and Rupigny on the north, died away indecisively. The Guards did not arrive till 3 o'clock, the artillery and cavalry were then still absent.

The fatal inactivity which had characterised the French movements previous to Mars-la-Tour seemed to clog their efforts still. Clearly, before they could hope to push their way north between Malroy and Charly they must turn the Germans out of Servigny. Therefore, it was arranged that while Le Bœuf, with the 2nd and 3rd Corps, should advance on both sides of the Ste. Barbe valley and outflank the enemy at Servigny, the 4th Corps, under Canrobert, should attack them there in front, while the 6th Corps, also under the same command, was to assail the 3rd Reserve Division at Charly-Malroy. The Guards were to be in reserve. Thus it was that General von Manteuffel found himself opposed by Canrobert and Le Bœuf at the head of a very superior force. He determined to face them on the line Servigny, Poix, Failly, because it afforded favourable positions for his artillery.

As the French pressed on in the full tide of a powerful advance they were met by the fire of line of batteries which grew as others came up until 60 guns were united under the command of General von Bergman, in general from 800 to 1000 paces "in front of the line of defence."[1] The enemy's batteries were quickly silenced by the mass of guns thus conspicuously thrown forward, and their infantry came to a standstill. It was only by creeping up the valleys that even the skirmishers could make headway at all, and some of these from the neighbourhood of Nouilly with the long ranging Chassepôt caused much annoyance to the left flank of the line of German guns.

Marshal Canrobert on the north made a determined attack in the evening on Failly, but the east Prussians, who formed its garrison, though attacked on two sides and pelted with bullets, stood firm until they were reinforced by the Landwehr brigade from Vrémy.

On the south, however, where the 2nd and 3rd Corps had only the 3rd Brigade of the 1st Prussian Corps opposed to them, the efforts of the French were more successful. Noisseville, Montoy, and Flanville were all in turn captured, and the swarms of skirmishers in the valley to the south of Servigny at length compelled the brave batteries of the 1st Division to shift their ground and fall back to the line held by their infantry between Poix and that village. Some batteries in retiring had to keep the riflemen at bay with canister, but the steady and well directed fire of the others prevented the enemy from making any marked progress in front, although, on the flanks, the situation of the artillery was at times very critical. The whole ten batteries had, however, maintained their positions with "visible success" for two long hours, and had almost alone stemmed the strong flood-tide of the French assault.

[1] Official account. Part I., Vol. II.

At Servigny, however, in spite of the reverses on their left, the Germans made a stand that nothing could shake, and in the evening even felt confident enough to deliver a sharp counter-attack, which drove the French over the slope.

In the darkness, at 9 o'clock, the French made another sudden assault on Servigny, but were thrust back once more, and at 10 o'clock both armies sought their bivouacs.

The next morning the same heavy mist which shrouded Sedan hung round Metz. The Germans had been reinforced by the 18th Division from the other side of the river during the night, and Bazaine, from his experinces the day previously, was but little confident of success, even before the fighting was renewed. The 3rd Brigade on the German side deployed across the Saarlouis road as early as 5 o'clock to check any further progress of the enemy on the left of the 1st Division. 24 guns were placed to sweep the open ground between Noisseville and Montoy, and after the former village had been cannonaded for some time, the infantry (43rd Regiment) stormed the village, but although they fought hard in the streets with two French brigades, they were eventually driven out again.

But now that the plans of Bazaine were made clear to his opponents, reinforcements, both from the north and south, were coming to the aid of the hard pressed 1st Division. The 28th Brigade of the 7th Corps advanced at 6 o'clock from Courcelles, the fire of its two batteries silenced the French guns at Montoy, set Flanville in flames, and by their action alone compelled the French to evacuate it at 9 o'clock. Marshal le Bœuf then ordered Bastoul's Division to make another attack on Montoy, but "the deadly fire of the Prussian artillery" compelled them to turn back.

As yet the French had not ventured again to face the dreaded line of guns along the Servigny position. Their 4th Corps was waiting ere it again advanced for the movement of the 2nd and 3rd Corps on its right, and they seemed able to make no progress.

For on the German side the 3rd Brigade had been reinforced by the 28th, the Hessian Horse Brigade now supported the 3rd Cavalry Division, and the number of batteries had also been augmented until 114 guns, under the superintendence of General von Bergman, swept the front with annihilating effect. The French artillery was reduced to silence, and a solid wall of artillery formed an impenetrable obstacle thus placed across the path of their 2nd and 3rd Corps. But their resistance implied something more than a merely passive defence.

The batteries south of Servigny had cannonaded Noisseville since 9 o'clock, and "had produced an effect far above what could have been expected. The village was in flames, the brewery buildings were riddled with shot, all the enemy's guns in the neighbourhood were reduced to silence, while his repeated attempts to bring up fresh troops to that point had ended in failure."[1] Thus it was that guns neutralised numbers, and seeing that the moment was ripe, the infantry of the 3rd Brigade rushed on and, supported by the Landwehr, stormed and carried the village at 11 o'clock.

[1] Official account.

Meanwhile, towards the north, Marshal Canrobert had got his batteries into position at 8.30, and their fire, assisted by that of the guns of the fortress, had driven their opponents for a brief period from Rupigny, but the village was soon recaptured, and three attempts to seize Failly were likewise foiled in succession by the Germans, who eventually assumed the offensive, and drove the French back over the Chieulles stream.

Marshal le Bœuf, in spite of the fact that he had still two divisions at his disposal, so little relished the idea of again facing the formidable mass of guns opposed to him that as the 3rd Brigade pressed on he retreated, and the news of his retirement reaching Bazaine, he ordered a cessation of hostilities all along his line about mid-day.

Thus 137,000 French, who had at their disposal 528 field guns and 96 mitrailleuses (we know not how many they actually unlimbered), had issued from Metz on the 31st of August, only to be repulsed by no more than 36,000 Prussians with 138 guns.[1] While even at the close of the 1st of September the force which held the French back did not exceed 69,000 infantry and 290 guns. For the first time during the war the French had commenced by an attack, and the Germans had shown that they could act on the defensive, even against enormous odds, with the same success that had attended them when strategy had placed a numerical superiority at their disposal. The Chassepôt had made itself severely felt, however, and cost them a loss of 3400, as against 3000 on the side of their opponents. But the German field guns had more than counterbalanced the rifle, its effect was decisive, and it was through his artillery that Manteuffel had been enabled to make the heroic resistance which has rendered Noisseville so celebrated.

The late Colonel Home, R.E., in his "Précis of Modern Tactics" has cited an example of the effect which masses of artillery may produce from this battle. It is that due to the artillery of the 7th Corps, under General Woyna, which "opened fire on Flanville, situated at a distance of about 1200 yards; the French infantry held this position strongly, and a close musketry fire had no effect on them; after a short time the two batteries detailed for this purpose overwhelmed the village with shells, the houses took fire, and the infantry abandoned them; the 53rd Regiment then advanced and took it. The guns were next turned on Coincy, which in a short time also became untenable, and the French retired. The German infantry during these operations remained with ordered arms."

Space forbids us to notice as we should wish many occasions during the remainder of this great war when German guns distinguished themselves, and that, too, not on a small scale, if their numbers are to be compared with that of many bodies of artillery which in these pages have received mention. We can only briefly, therefore, now refer to a few prominent examples, but it may be taken for granted that the same spirit which animated the batteries we shall allude to was found in no less marked degree amongst those we are compelled to pass by. *"Ex uno disce omnes;"* we will guarantee that the samples fairly represent what is left unviewed.

[1] Official account. Part I., Vol. II.

In what is known then as the Grand Duke's[1] battle, that which was prolonged for four days, the 7th, 8th, 9th, and 10th of December, 1870, near Beaugency on the Loire, between Tours and Orleans, the guns again were called upon to make up for a disparity of numbers, and the manner in which they responded to the appeal enabled their comrades to secure victory where defeat sometimes seemed perilously near. The French had been beaten in the two days' battle at Orleans on the 3rd

BATTLE OF BEAUGENCY-CRAVANT.—7th, 8th, 9th, and 10th Dec., 1870.

and 4th, and were falling back to the south and west. Their left wing, under the able Chanzy, was in better order than any other portion of their forces, and it was to it that the Grand Duke was now opposed.

[1] The Grand Duke of Mecklenburg-Schwerin.

On the 7th he advanced his left on Meung; Foinard and la Bourie were taken, and the enemy were also driven out of la Bardon by the guns of the 2nd Cavalry Division. Towards evening the French pushed strong forces out from Grand Chartre, and the Bavarians, who opposed them, fought a hard battle till night closed in, when hammered by the Horse Artillery the French fell back to Beaumont.

The next day the Grand Duke called the 22nd Division to his left from Ouzouer, and it moved on Cravant and Beaugency to effect a junction with the right of the Bavarians. During the movement the 2nd Bavarian Division which had been engaged at Cravant was driven back to Beaumont, but 17 batteries were deployed in the fighting line, and their fire so checked the enemy that the Bavarians were able in a subsequent counter-attack to recover the high road to Beaugency.

The French, however, returned to the charge, and a powerful artillery prepared the advance of the whole of their 17th Corps on Cravant. The 22nd Division of the Germans had, however, reached that place and drove the French out of Beauvert and Layes as it advanced. An artillery line of 36 guns was quickly formed and placed in front of Beauvert, and protected by four brigades of cavalry it stood its ground and beat off the French attacks. Two batteries of Horse Artillery at la Carrefour also compelled two French cavalry regiments, which attempted to turn the German right flank, to retire in such haste that the cavalry with them, although they galloped in pursuit, could not overtake them.[1]

The wearied Bavarians in the dusk of evening tried to push forward again to the heights between Cernay and Villevert, but were forced back once more by fresh hostile forces advancing from the south, and compelled to retreat to Beaumont. The pursuing enemy, however, found in the line of artillery, against which he speedily stumbled, an insuperable obstacle, and torn by its fire he abandoned le Mee and Villechaumont without a struggle as night closed in.

On the 9th, although an effort was being made to reinforce the Grand Duke, he was still facing 11 French divisions with only 4; and at dawn Chanzy sent strong columns to the charge against him at le Mee.

Dense bodies of tirailleurs were repulsed, however, both there and at Vernon, under the fire of "the devoted German artillery,"[2] which silenced their guns, and then opened fire on Villeorceau, which was captured by the Bavarian infantry three hours later. The close of a most momentous and hard day's fighting saw Cernay, Ourcelle, Villejouan, and Villeorceau in German hands, while, not alone did they hold their positions, but a line from Ourcelle to Tavers marked ground they wrung from the French, who in the evening fell back to Josnes and Dugny.

On the following day (the 10th), however, Chanzy once more renewed his attack, and forced his way into Villejouan. Six batteries at Villechaumont were brought into action to check him there, while two

[1] Official account. Part II., Vol. II.

[2] Von Moltke.

battalions and four batteries held Villemarceau against every effort of the French. At 12 o'clock the main body of the Germans felt strong enough to advance to try and repossess themselves of Villejouan, and for the next four hours a desperate struggle raged round that position. The French then brought up fresh forces to sweep the remaining Germans away, but meanwhile a great artillery line had been developed to the south of Villemarceau by the artillery of the 17th Division, two Horse Batteries of the 10th Corps, and the batteries of the 22nd Division. The fire of these guns put an end to any further attack of the French 17th Corps.

But strong columns of the 21st Corps, on this day, for the first time, realising where the Germans were most vulnerable, had advanced at 10.30 o'clock on Villermain, and the toil-worn Bavarians had to form a line from Jouy to Coudray to oppose them. Once more guns were called upon to fill the breech, and by degrees a great mass of 19 batteries was built up in that position, whose "*visibly effective fire*" compelled the French to take their artillery out of action at 3 o'clock' and to limit themselves for the remainder of the day to such isolated and feeble assaults as were thrust back with comparative ease.[1]

Thus ended the four day's fighting of Beaugency-Cravant, where the Grand Duke held his own against three corps of the enemy, and was enabled to do so by "the bravery of his troops, more especially of the artillery. This alone lost 255 men and 356 horses. The guns were brought into such requisition that at last almost all the steel guns of the light batteries of the 22nd Division, and most of the Bavarian, were rendered useless by the burning out of their breech-blocks."[2]

An especially interesting artillery battle is that of Loigny-Poupry, when the effort of the Army of Orleans to reach Paris on the 2nd of December was stifled by the Bavarians, and a large share of the fighting fell to the guns. The incidents of the struggle exhibit almost every phase of artillery usefulness, and illustrate every possible *rôle* which the arm can be called upon to assume.

To give an account of the fight in a manner which would at all adequately convey all that can be learnt from it would, in the space here available, be hopeless. The deeds of the German gunners have been made the subject of an excellent paper in the *Kriegsgeschischtliche Einzelschriften*,[3] which are published by the great General Staff in Berlin, and those who would study the matter in greater detail must there seek for information. Colonel Lonsdale Hale also gave an interesting lecture on the performance of the artillery at this battle last year at Aldershot, but this unfortunately is not published, and cannot therefore be referred to, although it is through him that attention in this in this country has been called to the battle. To give but a brief outline of the fight:—

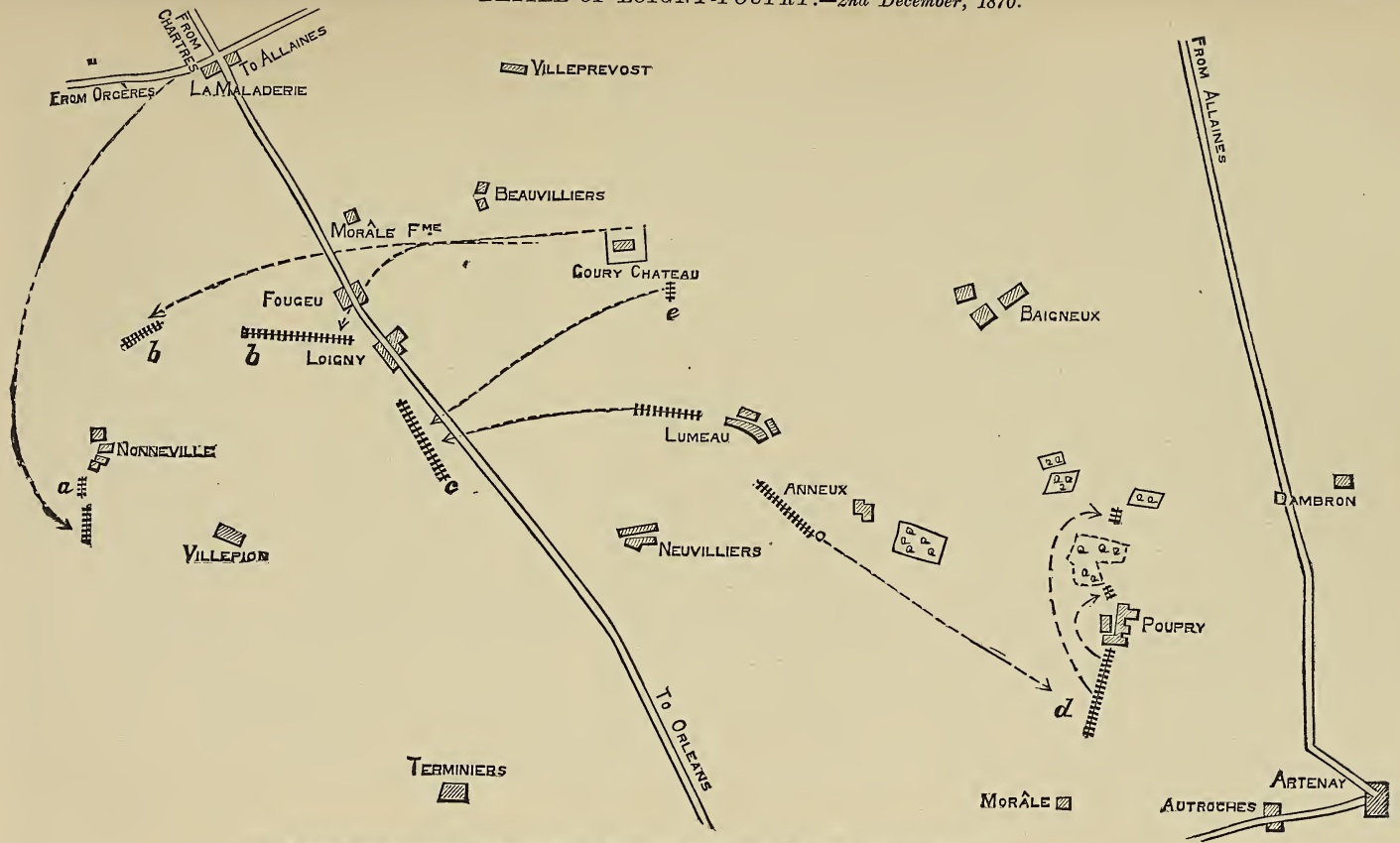
On the morning of the 2nd December the 1st Bavarian corps was formed, facing south-west, at La Maladerie, and the French advanced

[1] Official account. Part II., Vol. II.

[2] "The Franco-German War," by Von Moltke. Vol. II.

[3] Vol. VII.

BATTLE OF LOIGNY-POUPRY.—2nd December, 1870.



a. Position in the evening of the Horse Artillery Batteries of the 4th Cavalry Division.
b b. " " " " Batteries on the right and left of the 1st Bavarian Infantry Division.
c. " " " " Artillery of the 17th German Division.
d. " " " " " " 22nd "
e. 1st " " " " 2 Horse Artillery Batteries of the 17th Division.

from Terminiers, Villepion, and Nonneville for Loigny and Lumeau, about 8 o'clock. Meanwhile General von der Tann had received orders to join the German forces to the east, and to take up a position with his left resting on the Park at Chateau Goury. At the same time he was informed that the 17th Division was moving on Lumeau, the 22nd Division on Baigneux, and that the 4th Cavalry Division would cover his right. In accordance with these orders his corps took ground to its left, but while the movement was in progress the French advance assailed it, and the 2nd Division was deployed in action between Beauvilliers farm and Goury at 9.30 o'clock, while six batteries formed a solid framework for the infantry. The detachment of the Bavarians at Lumeau fell back before the French advance and hastened to put the park and chateau of Goury in a state of defence.

The French 2nd Division, however, pressed on triumphantly in spite of the heavy fire of the German guns, until close to Beauvilliers farm, and its skirmishers got within 500 yards of the hostile batteries, which suffered heavily under their fire. But then the 3rd Bavarian infantry brigade made a most brilliant and successful counter-attack. Two of the batteries which had just been standing firm to stem the forward rush of the French riflemen sprang forward with it, and lent their fire to aid its advance. The others were no less active in support, and from positions further to the rear sustained their comrades. Brilliant success at first attended the bold dash of this brigade, and the French were pressed back as far as Loigny in something like a rout. But such isolated enterprises rarely lead to permanent advantage, and when the whole French corps advanced on the line Nonneville Neuvilliers, it had to fall back once more, having suffered heavy losses. During this retreat the guns, which had accompanied the infantry, boldly unlimbered in the firing line, and were frequently the last to face the pursuing enemy.

As the brigade eventually neared the former German position, between Beauvilliers and Goury, which was once more occupied by batteries, it made straight on the guns, and passing through their intervals rallied behind them. Thus it was that the fire of the artillery was masked until the very moment their foe was upon them, and that they had to face his skirmishers absolutely unsupported for a time by any rifles. Two batteries on the west of Beauvilliers farm also lent their best endeavours to stop the advance of the enemy, but the deadly Chassepôt was too much for them, and when the hostile marksmen got within 600 metres, they had to fall further back and take up a second position.

Two batteries from the artillery reserve were now hurried up to the weak spot, and although they had to unlimber in the very firing line, they, in conjunction with the others which had been driven back, were able to form an artillery line behind which the infantry could rally. Two Horse Batteries from the 17th Division at the same moment came into action to the south of Chateau Goury, and taking the enemy in flank by their fire, also assisted to put a stop to his advance at this point.

At 11.30 the 2nd Bavarian Brigade began to join in the fight, and

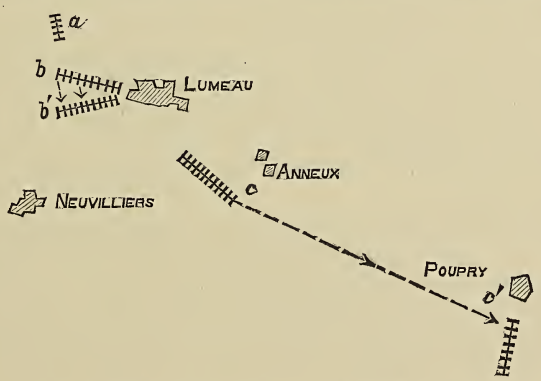
four Horse Artillery Batteries and one Field Battery came into action to the north-west of Beauvilliers, while subsequently the 4th division of cavalry, wheeling round with its Horse Artillery, charged the left wing of the French, who fell back before the Bavarians until the latter gained possession of Morâle Ferme.

This success on the right soon spread to the left, and the Bavarians made another counter-stroke from Beauvilliers and Chateau Goury, the artillery of the 2nd Division, and the batteries which had come to its aid, once more advanced with the infantry, and the French were forced back to Loigny.

But the incidents crowd on one another in this battle with bewildering rapidity.

Hardly had this advance of the Bavarians got fairly under weigh when an energetic counter-stroke from their opponents forced them back once more to Chateau Goury, and even threatened their safety there. The artillery were in some cases again forced to oppose the rush of the French skirmishers at 300 or 400 metres' range, and suffered heavily in their gallant efforts.[1]

But the 17th and 22nd Prussian Divisions were now appearing on the scene of action, and were soon threatening the right of the French. The artillery of the 17th Division was hurried on to engage the enemy, and to prevent his gaining possession of Lumeau, while two Horse Artillery Batteries, as we have seen, assailed his right flank and stayed his progress between Chateau Goury and Lumeau. The infantry followed the guns no less ardently, and reinforced the detachments which were holding the village against the foe. The guns of the 17th Division wheeled to their left as he came on, and smote the left flank of his attack on Lumeau with their fire, while those of the 22nd Division came into action on the south-east of the village, and the combined fire of



a 2 Horse Artillery Batteries of 17th Division.
b b' Artillery of the 17th Division.
c c' 1st and 2nd positions of artillery of 22nd Division.

the mass of artillery thus formed, taking the enemy in a most vulnerable point, had the best possible results. The batteries also accompanied

[1] The 10th Heavy Battery of the 4th Bavarian Regiment of Artillery lost in a short time 2 non-commissioned officers, 15 men, and 24 horses. Yet were able to hold their ground.

the infantry in their subsequent advance, and the manner in which they were moved, favoured by alternate echelons, receives high praise in the account of the German Staff.

When the fighting at Lumeau was over, and the enemy had been driven, as he was, in utter rout towards Terminiers, the 17th Division wheeled to its right and, under cover of the fire of eight batteries, fell on the right of the French assailing Beauvilliers and Chateau Goury. Taken by surprise they gave way and were driven to Loigny, from whence they were again forced back to Villepion, shattered by the destructive fire of an enormous mass of guns which, as the Germans gained ground on the west and north, grew, until 26 batteries or 154 guns stood in a great semi-circle round the ruins of the 16th French Corps.

A gallant counter-attack, however, by the Papal Zouaves late in the afternoon on Villours and Loigny yet once more forced the Germans back, and the batteries were in many cases obliged to fire case to keep the foe at bay.

But the last reserves were now led forward. A general effort of all the troops engaged was equal at the last moment to holding off the danger, and as night closed in the fighting ceased.

Meanwhile an entirely distinct fight had been raging at Poupry, in which the German guns had played a no less predominant share.

While the 16th French Corps was engaged in the battle we have just been describing, the 15th Corps had advanced past Artenay on the road to Paris, and attacked with the 3rd Division the 3rd German Brigade of Cavalry.

The 22nd Division under Von Wittich was, as we have seen, in the act of wheeling to its right to support the attack of the 17th Division on the right flank of the French battle west of Lumeau. When the news of the menacing inroad behind him was brought to Von Wittich, with swift decision he altered his direction entirely and wheeled round on his left to face the new danger. Hurrying the guns in front of the infantry, some of whom, in their anxiety to gain Poupry before their opponents, reached the new battle-field at the double, he had soon six batteries in action between Poupry and Morâle, to oppose which the French deployed between Dambron and Autroches, and rushed to the attack of that village.

The German batteries first engaged the hostile artillery which came into action to the north-west of Artenay, and soon silenced their fire, then they drove off some bodies of the enemy's cavalry which attempted to advance, and having thus disposed of the other arms they turned their attention on the French infantry who were gathering in greatly superior strength on the high road between Artenay and Poupry for the assault of Loigny.

The Germans were now reinforced by the other brigade of their division, but the great strength of their opponent seemed likely to envelop their flanks. To hold him fast in front, therefore, Von Wittich directed a counter-attack on him from Poupry, and also gained possession of the woods to the north of that village. But the French right wing about 3 o'clock felt powerful enough to strongly assail the

German left from the small copses which they held to the north of the woods which they occupied. Two German batteries moved round from their first position and, coming into action between the woods, drove off the French attacks several times with their fire, although they too were compelled at times to shift their ground. The 3rd Brigade of the German cavalry now also moved round to the open ground west of Dambron and threatened the French flank in a manner which checked their forward movement. Meanwhile an attack on the German right from Autroches was stalled off in a great measure by the effective shells of the batteries on that wing.

Finally, at 4 o'clock, the French made a great effort all along their line. They were repulsed on the south and in the centre, but drove back their opponents for a time on the north of Poupry. The last reserves of the Germans being called into the fight, however, once more restored the balance, and the approach of darkness put and end to the battle.

The day had cost the French 4000 killed and wounded, and their foes fully as many; but 2500 unwounded prisoners, 8 guns, 1 mitrailleuse and a standard were left as trophies in the hands of the Germans.

This battle is full of instruction for Artillery officers, and the arm is seen intervening predominantly, often in spite of most adverse circumstances, in all the incidents of a fight exceptionally eventful and full of variety, and its value asserted itself, moreover, in the most many sided manner.

It is first seen forming the frame-work of resistance in the line of battle, and the waves of the attack are shattered on its front. Then we find it boldly enveloping the French left and asserting its activity and enterprise in a counter-attack, which is driven home by the weight of every available battery, while the Horse Artillery prove themselves so swift and venturesome that they sweep round until they are almost assailing their foe from the rear of his position.

Turning southwards, the guns of the 17th Division are next conspicuous, at first beating down the fire of the hostile guns, then pouring their shells on the assault of the battalions, and finally, when their division is in its turn taking the offensive, wheeling round and joining in the attack in the most effective style.

When the 22nd Division arrives on the scene its batteries are sent forward and prepare the way for the advance of the infantry. Then, concentrated in a weighty mass, they fasten on the enemy's flank, and their heavy blows shatter and disorganise his efforts. At length, smothered by the fire of 70 pieces, he is forced to give way.

Finally, when the new and unexpected danger threatens the Germans from the direction of Artenay, the guns show themselves no less stubborn in warding off the rush of the French in far superior numbers, and enable the hard pressed infantry to hold their ground.

The advantages of assailing a foe with fire from the flanks is well illustrated, and it is when guns can thus be brought to bear that they produce the most marked results, while throughout the day the importance and advantage of keeping the direction of batteries con-

centrated in the controlling grasp of one superior officer are well brought out.

With this example we must close our record of what the German guns accomplished in a campaign so decisively victorious that the losses of the vanquished amount to figures most astonishing. For, leaving out of sight the killed and wounded, Metz and Strasburg, 21,508 officers and 702,048 men as prisoners, 107 flags and eagles, 1915 field, and 5526 fortress guns remained, very tangible trophies of success, in the conqueror's hands. And in the story of how so vast a triumph was reaped, what will perhaps equally astonish the sympathetic reader is the consciousness of strength which made the German guns, in spite of the disadvantages imposed upon them by the Chassepôt, never hesitate to join issue with their opponents, no matter to what arm of the service they belonged, who, it is also to be noted, frankly have admitted that this confidence in the power of their weapons sprung less from a knowledge of their ballistic superiority, than from a sense that careful training in their handling, both technically and tactically, had given their fire a precision and focus which those they were engaging could not match.

Is is by no means contended that the tactics employed were always justifiable, but, at least, artillery was understood and appreciated by those in general command as it had never been since the commencement of the century, while, if the tasks set were often great, the guns never failed to act up to what was expected from them. Whether justice has invariably been done to the physical effect they produced is a matter into which we will not now enter, although subsequently we may perhaps briefly discuss it.

(To be Continued).

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PRÉCIS

AND

TRANSLATIONS.

"RUSSIAN ARTILLERY JOURNAL."

PRACTICE AT SNOW PARAPETS.

TRANSLATED BY

CAPTAIN E. A. LAMBART, R.H.A.

THE question of the resistance to field artillery projectiles offered by fortifications constructed of snow is of some importance, especially to those countries where the ground is covered with snow almost half the year.

Cases are very probable where troops will have to entrench themselves in the winter; the frozen ground offers very great resistance to digging, and in this respect resembles stony ground. In raising fortifications on such ground it is necessary to have recourse to transported materials, as it is impossible in a short time and with ordinary means to get any sort of cover out of stony ground; whilst at hand lies an immense quantity of a material which is very easily heaped up, namely snow.

Having decided to make use of snow fortifications it is necessary to decide on the dimensions which the profile must have in order to give cover which will not be penetrated by the enemy's projectiles, and for this we must know how far the projectiles of field artillery will penetrate snow. It is further necessary to know the best way of digging up the snow. Whether it should be trampled down as it is thrown up. Whether advantage can be taken of the ice, &c.

The following experiments were carried out before a special commission at the Oost-ijorski camp in February 1890, and March 1891.

EXPERIMENTS IN 1890.

These experiments were so to speak preparatory: their object was to decide the best form of parapet for further experiments. For this purpose a parapet 5 feet high and 40 feet frontage was constructed in 5 portions of 8 feet each—each of them was made differently:

1st portion 14 feet thick made of unrammed snow.

2nd portion 8 feet thick made of snow trampled down as it was thrown up.

3rd portion built up of 6 rows of ice blocks $2\frac{1}{2}$ feet thick faced with snow 1 foot thick

4th portion 7 feet thick was built of snow saturated with water as it was thrown up.

5th portion $8\frac{1}{2}$ feet thick was built of bags of snow each weighing about 10 lbs.

2[1] light field and 2 heavy field guns of the 1st Artillery Brigade were told off for the experiment.

As the object of the experiments was to ascertain the penetrative power of the projectiles, the range was very short, about 700 yards, which, moreover, was known to the battery commander: thus it was not necessary to waste any rounds in ranging.

Flags were placed in the centre of each section of the work to distinguish it, and the guns were laid on these. Only common shell were used, some with bursting charges and some empty.

The experiments began with the light guns. The range table elevation of the first two rounds resulted in the shot striking the left upper corner of the parapet, so the elevation was diminished half a "line," after which the shell began to strike round the flags marking the centre of the sections.

It was remarked that whilst the flags remained intact, the firing was very accurate, as might be expected at so short a range; but when the flags had been knocked away the firing became less accurate and the laying was carried out with great difficulty. After 2 rounds had penetrated the work, 4 more were fired and then the parapet was examined.

It turned out, as it had appeared from observation, that the filled shell did not go through but burst in the work. When the point of impact was not far from the superior slope, the shell made a slight furrow on the snow surface, much like that made by common shell in loose soil; where the shell buried itself deeply it made a kind of puff, indicated on the surface by a wave of smoke. After this inspection of the work, plugged shell were fired from the light guns at each section of the target. All the sections except the third were pierced; of the two shells fired at this section, one penetrated it and the other glanced off. The snow with which the ice was faced was scattered by the first impact, and the ice behind threw off splinters to a distance of 50 and 60 yards. After this 2 plugged common shell were fired from the field battery guns at each section: all the projectiles pierced the parapet.

When the penetrative power of field gun projectiles against snow works had been thus demonstrated, experiments were carried out to decide the resistance of snow to the bursting power of shells.

44 shells from the light and 25 from the heavy guns were fired with the following results:—

No. 1 section hit by 4 heavy shells.							
,, 2	,,	,,	2	,,	and 14	light	shells.
,, 3	,,	,,	6	,,	10	,,	
,, 4	,,	,,	6	,,	10	,,	
,, 5	,,	,,	8	,,	10	,,	

The inspection of the parapet at the end of the practice shewed that sections 2 and 4 had suffered most: they were shattered more than half-way down, and made a very sorry appearance.

Observation of the bursts shewed that with 8 feet thickness, the burst occurred almost at the moment of the exit of the projectile on the inner side, that is exactly where troops sheltered by the parapet would be.

In No 1 section the bursts occurred after a penetration of 8 and 9 feet. Thus it appears that a thickness of 9 feet does not give protection.

The ice in No. 3 section showed great resistance to the penetration of filled shell which burst before they had penetrated very far into the ice. The shell made a furrow at the point of impact on the ice-block, from which splinters were

[1] 17-prs. and 30-prs.

scattered in all directions. In one block two furrows from shells were observed but the block remained whole.

Such very great resistance points to the usefulness of ice as a material for fortification. But as we have seen above the shell when it strikes the ice throws off from it an immense number of splinters, which largely add to the number of destructive fragments, and this property of ice renders it decidedly disadvantageous for the above-mentioned purpose.

In anticipation of this result, the ice, as we have said above, was covered with snow 1 foot thick; but this snow was scattered by the first shot that struck the section: this happened partly no doubt owing to the snow that was used being very crisp, almost like fine sand. Possibly soft snow would have lasted longer, and would have prevented the ice throwing off so many splinters.

In the 5th section the snow bags were much scattered and the parapet destroyed half-way down, but it still offered a certain amount of cover.

We now indicate the conclusions come to from these experiments:—

(1) A parapet of ordinary snow of sufficient thickness, affords a very solid protection from field gun projectiles. Although the 1st section, 14 feet thick was pierced by the empty shell, the filled shell only penetrated 9 feet; this shews that a parapet 14 feet thick would be perfectly safe.

(2) A similar result may be expected from a snow bag parapet; but taking into consideration the immense number of bags and the quantity of snow to be dug, this form of parapet seems very disadvantageous.

(3) Trampling the snow and wetting it do not diminish the thickness of parapet necessary. 8 feet is not sufficient.

(4) Ice unless strongly faced with snow, is no use for a parapet; but if a durable facing could be arrived at, we might come to a different conclusion.

Unfortunately the 1st section, which from the simplicity of its construction would be the most useful form, was hit by only a few projectiles, so that no opinion could be formed of the effect on it of a large number.

Experiments in 1891.

From the results of the previous year's experiments, it was decided to confine this year's experiments to parapets of snow thrown up in the ordinary way, and of snow trampled down as it was thrown up.

The object of the practice of 1891 was to fix the minimum thickness of parapet that would be impervious to field artillery projectiles. The maximum thickness of the experiments of 1890 viz., 14 feet, having proved insufficient.

With this view it was decided to make two parapets of trapezoidal form, with a maximum thickness of 30 feet and a minimum of 15 feet. Two such parapets were constructed, one of snow thrown up in the ordinary manner, and the other of trampled snow; both parapets were joined at their 30 feet extremities and formed so to speak one parapet 30 feet thick in the middle and 15 feet at the ends—height throughout 5 feet. Looking from the battery the right half of the parapet was of ordinary snow and the left of trampled snow. The sections of the parapet were divided by a board to assist in aiming. The practice was carried out from two 17-prs. and two 30-prs. of the 1st Brigade, with 60 17-pr. common shell and 54 30-pr. shell; range 700 yards. At such a range very accurate practice was to be expected but as a matter of fact it was not so, the reason being that there was no aiming point.

It seems that it is very difficult to lay at snow targets even at such short ranges.

The practice commenced with plugged shell. Orders were given to commence firing at the centre of the target and to pass on to the flanks; the heavy guns to fire at the loose snow portion, and the light guns at the rammed snow. The

practice was carried on till shells were observed to pierce the parapet. 22 light and 22 heavy plugged shell were fired. The average penetration was 18 feet.

After this the practice was continued with filled shell from the light guns at the loose snow, and from the heavy guns at the rammed snow.

The effect of the filled shell on the parapet was the same as observed in the previous year. After firing 38 light and 32 heavy shell, the parapet (70 ft. long) was destroyed half-way down, though it still afforded some cover. On examining the parapet at the end of the practice, the plugged shell was found at a depth of 18 and 22 feet, the depth being greater in the loose snow. Splinters of the filled shell were found at a depth of 6 and 20 feet.

The results of the 1891 practice shewed :—

(1) That plugged shell would pierce 18 feet of snow.

(2) That 22 feet of rammed snow and 25 feet of loose snow would give cover against field artillery projectiles.

(3) That splinters of shell did not penetrate more than 20 feet.

(4) That it is extremely hard to lay accurately at snow works.

These results indicate the best form of snow parapets as one of loose snow 25 feet thick.

The range of course in actual warfare would be much greater than 700 yards.

The difficulties of laying would also be immensely increased at longer ranges, especially against parapets artificially concealed (by screens, &c.).

The penetration moreover, varying inversely as the range, enables us to fix 25 feet as the maximum thickness, which might be largely diminished at long ranges especially if time was short.

The striking force of a projectile is represented by its momentum on impact, which varies as the square of the velocity.

These experiments, therefore, do not give us much information as to the effect of fire at medium or long ranges against such works.

The remaining velocity of the 17-pr. at 3500 yards is hardly one-fourth of its velocity at 700 yards.

Next year it is proposed to carry out further experiments at medium and long ranges.

NOTES

FROM

CORRESPONDING MEMBERS.

THE Secretary has a few copies of the new edition of "Kane's List" which were not subscribed for. These are now on sale at £1 each.

ANY member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

THE Records of the Royal Military Academy are about to be re-published in the original form, with additions and drawings, bringing it up to date; the estimated cost will not exceed 12s. 6d. a copy.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

A NEW "Kane's List" having been recently published, and progress having been made in collating relationships of R.A. Officers past and present, Officers are requested to notify to the Secretary, R.A.I., any relationship existing between them and any other officer of the same name registered in "Kane's List."

THE subject for the Duncan Gold Medal Prize Essay, 1892, is: "Fire discipline; its necessity in a Battery of Horse or Field Artillery, and the best means of securing it.

Attention is called to the Rules for Prize Essays, &c., and Officers are asked to be careful in posting their essay intended for competition in time to reach the Secretary before the 1st of April.

A MOST simple note-book has been designed by Captain S. W. Lane, R.A. to enable a Commanding Officer to range his Battery without working out any calculations. Its size will not exceed $4\frac{1}{2}$ inches square. By an arrangement of folding flaps on the cover at each end it can be used for any range between 1000 and 4200 yards.

The Officer ranging writes down in the margin the range at which he opens fire, so that there may be no possible error as to which flap is in use, and after the first round notes + or — only in the columns opposite the range at which each shot is fired; he sees at a glance what elevation is midway between the last + and — and gives it out for the next round and again divides after it is observed until he can do so no longer, when he verifies and enters in another column opposite the range at which he has verified the length of fuze with which he begins shrapnel.

The Secretary, R.A.I., has a sample book which he will be happy to send out "on loan" for inspection, and he will also be glad to hear from Officers who think of ordering a copy on sale, in order that he may know how many to prepare.

The cost will probably be about 1s. a copy.

THE Committee have been asked to send out Regimental Lists earlier each month to any Officer willing to pay the extra expense of sending them separate.

They wish to notify that the " Proceedings " are sent out directly the Lists are ready, and in no case would the latter be received a week earlier if sent separately.

The date up to which the Lists are corrected each month is not the date of printing, but of corrections made at the Horse Guards.

THE Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

A CATALOGUE of works (Authors' Index) added to the Library from 1882 to present date is being prepared; a copy will be sent to any Member applying for one.

THE Museum is now being replaced after being so long closed for the repairs to the roof.

Specimens of all sorts are turning out in much better order than might have been expected after being untouched for so many months.

Few Members seem to know how good is the Institution Ornithological Collection and the books on this subject in the Library are not surpassed by any private collection.

THE Committee will be glad to receive specimens of the Indian and Eastern birds noted below. In preparing for collections birds should be carefully skinned, cleaned, dried and dressed with arsenical soap; the skull should be left in thoroughly cleaned out, the eye sockets well filled out, the body moderately filled with cotton wool or even paper if no other material be handy. Each specimen should be thrust head downwards in a clean paper funnel and kept there until thoroughly dry. To a leg of each specimen should be attached a label showing when and where shot, colour of eyes and all naked parts.

INDIAN BIRDS.

Painted Partridge.
Grey Partridge.
Jungle Bush Quail.
Chinese Quail.
Ruddy Rail.
Brown's Rail.
Blue-breasted Rail.
Indian Blue Coot.
Painted Snipe.
Wood Snipe.
Tereke Sandpiper.
Eastern Curlew.
Large Sand Plover.
Mongolian Sand Plover.
Sociable Lapwing.
Red Wattled Lapwing.
Yellow Wattled Lapwing.
Stone Plover.
Great Stone Plover.
Indian Courier Plover.
Eastern Swallow Plover.
Small Swallow Plover.
Crab Plover.
Indian River Tern.
Black-bellied River Tern.
Caspian Tern.
Gull-billed Tern.
White Shafted Ternlet.
Grey-rumped Ternlet.
Large-crested Tern.
Lesser-crested Tern.
Sooty Tern.

Great Black-headed Gull.
Brown-headed Gull.
Green-billed Shearwater.
Indian Combgoose.
Green-backed Goose Teal.
Indian Whistling Teal.
Spotted-billed Duck.
Spoonbill.
Pelican Ibis.
Shell Ibis.
Black-headed White Ibis.
Hair-crested Stork.
White-necked Stork.
Giant Heron.
Green Heron.
Ashy Heron.
Large White Heron.
Plumed Heron.
Little Egret.
Cattle Egret.
Pond Heron.
Green Bittern.
Eastern Little Bittern.
Black Bittern.
Chestnut Bittern.
Malay Bittern.
Brown Gannet.
Yellow-eyed Gannet.
Little Cormorant.
Grey Pelican.
Lesser Frigate Bird.
Demoiselle Crane.

The following extract is taken from "Recollections of My Military Life," by Colonel Landmann, late of the Corps of Royal Engineers, London, 1854. The Author states in the Preface "My records are the result of memory, largely aided by voluminous documents, journals, and copious notes on the spot. . . . I feel satisfied that my statements may be received and repeated as historical facts."

The extract is part of the account of the combat of Roliça, fought on 17th August, 1808, between the English and Portuguese under Sir Arthur Wellesley, and French under General Laborde. The Artillery that took part in the combat are now represented by the 37th Field Battery, 1/2 Depôt Division Field Artillery, and the 11th Company Southern Division, R.A.

The extract is as follows :—"Within fifty yards of the above-mentioned four windmills, I found Lieutenant-Colonel Robe, of the Royal Artillery, preparing to open a battery on the enemy, whom we could in many places perceive, notwithstanding the thick pine forest they occupied. . . .

The battery being ready to open, Robe, near whom I was standing, turned to me and asked what I considered the distance to be from our position to the enemy's line, in a rather oblique direction to our left, where the high road was seen winding into one of the ravines, and which appeared to be guarded by a Swiss regiment, with red coats and sky-blue facings. I answered that I thought the distance might be about 800 or 900 yards; upon which Robe observed, 'I think that must be very near the mark;' and added, 'I'll try a shrapnel at them for that range.' He accordingly ordered a fuze to be cut for 850 yards.

I now took out my glass, and having ascertained the exact part of the line at which the gun had been pointed, I went a few yards to the left to clear the smoke, and when the shell was fired it burst beautifully, at a short distance before it reached the line, upon which I immediately noticed a great number of the enemy drop on the ground. A second shell was discharged with similar result; when I suggested to Robe not to fire any more on that part of the line, in order that we might judge by the number of killed what number on the whole might have been wounded and killed by the two shells, for we were sure of gaining possession of the ground they then occupied.

The fire was afterwards directed over the heads of the attacking columns on two 4-pounders, planted at the head of a ravine, in which our troops were ascending and suffering very much from a rapid discharge of cannister. These guns now turned their fire upon us with round shot, and we thus relieved the infantry from the cannister fire. . . . I completed a panoramic view of the battle drawn from the place close to where stood the guns under Robe that had opened on the French Artillery and Swiss Regiments with shrapnell (*sic*) shell; *the first time of their being used in a field engagement.*"

Colonel Landmann does not seem to have carried out his idea of visiting the ground near where the shells burst.

RESULT OF R.A. MATCHES—1891.

Matches played, 14. Won, 9. Drawn, 5. Lost, 0.

Opponents.	Where played.	When played.	R.A. 1st Innings.	R.A. 2nd Innings.	Opponents. 1st Innings.	Opponents. 2nd Innings.	Remarks.
Won.							
Aldershot Division ...	Aldershot	29 30 May	255	—	130	87	Won by 1 innings and 38 runs.
R.M. Academy	Woolwich	4 5 June	157	†56	139	71	Won by 8 wickets.
Royal Marines	"	15 16 June	252	—	122	99	" 1 innings and 33 runs.
Royal Engineers	"	19 20 June	264	127	*239	151	Won by 5 wickets.
Yorkshire Gentlemen	"	24 25 June	212	—	49	106	" 1 innings and 57 runs.
Green Jackets	"	26 27 June	244	—	48	142	Won by 1 innings and 54 runs.
B.B.	"	17 18 July	359	—	99	191	Won by 1 innings and 69 runs.
Household Brigade ...	Chelsea	20 21 July	295	°51	132	213	Won by 8 wickets.
Royal Engineers	Chatham	24 25 July	271	—	172	98	" 1 innings and 1 run.
Drawn.							
Free Foresters	Woolwich	18 19 May	192	—	163	—	Rain. No play first day.
Harlequins.....	"	6 7 July	178	—	‖259	—	Rain.
Gentlemen of M.C.C.	Lords	22 23 July	216	§210	177	‡183	
Mote Park	Mote Park.	27 28 July	105	131	156	—	Rain.
I. Z.	Woolwich	3 4 Aug.	218	—	78	¶258	Rain.

†3 wickets. *5 wickets. ‖9 wickets. °2 wickets. §6 wickets—Innings closed.
‡7 wickets. ¶5 wickets.

WOOLWICH.

CRICKET during the past season was very popular here, and the season may be considered a successful one for the R.A. Woolwich team, which won the first eight matches it played.

Matches Played, 12. Won, 9. Lost, 3.

Batting Averages.

Names.	No of Innings.	Times not out.	Runs.	Most in an Innings.	Average.
Lieut. A. C. Currie	5	—	198	117	39·80
" C. H. de Rougemont	12	—	409	77	34·08
Capt. F. A. Curteis	10	1	290	50	32·22
Lieut. J. P. Du Cane	6	—	171	63	28·50
Lieut. H. D. White-Thomson	5	—	132	65	26·40
Major W. L. Davidson	8	—	156	61	19·50
Capt. E. J. Phipps-Hornby	14	—	272	79	19·43
Major A. S. Pratt	13	3	171	41	17·40
2nd Lieut. G. Mathew-Lannow	5	—	74	56	14·80
Capt. E. H. Armitage	8	4	57	18	14·25
Lieut. J. A. Rich...	9	—	116	32	12·88
Capt. A. M. C. Dale	5	—	60	29	12
Lieut. R. P. Benson	6	—	55	20	9·16

And 17 other players who played fewer than five innings.

OBITUARY.

Major-General Gronow Davis, V.C., late R.A., died at Royal Park, Clifton, Bristol, on the 18th October, 1891. He was commissioned 18th December, 1847, and as Second Captain served in the Crimean Campaign, 1855–6, including the Siege and Fall of Sebastopol and Battle of Tchernaya. Despatches, *London Gazette*, 2nd November, 1855. Medal with clasp and V.C.; 5th Class of Medjidie; Turkish Medal and Brevet of Major, 6th June, 1856; Brevet Lieut.-Colonel, 29th August, 1868; and Brevet Colonel, 1st October, 1876. He retired upon a special pension, with the honorary rank of Major-General, 29th October, 1881.

He received the Victoria Cross "for great coolness and gallantry in the attack on the Redan (Sebastopol), 8th September, 1855, on which occasion he commanded the spiking party, and after which he saved the life of Lieutenant Sanders, 30th Foot, by jumping over the parapet of a sap, and proceeding twice some distance across the open under a 'murderous' fire to assist in conveying that officer, whose leg was broken, and who was otherwise severely wounded, under cover; and repeated this act in the conveyance of other wounded soldiers from the same exposed position."

Captain Thomas Wright Blakiston, late R.A., whose death occurred at San Diego, California, on the 15th October, 1891, entered the Royal Artillery, 17th December, 1851, became Captain, 7th December, 1858, and resigned his commission 4th June, 1862.

He was one of that band of officers who, headed by Sabine and Lefroy, did so much to maintain for the Royal Artillery the title of "Scientific Corps."

In May, 1857, he left England to conduct the astronomical and physical observations on the "North American Exploring Expedition," under Mr. Palliser, and the results of this expedition may be best judged by the following extracts from the Proceedings of a General Meeting of the R.A.I., held on Wednesday, May 30th, 1860:—"The Committee cannot pass without notice the magnificent donation by Captain Blakiston, of the various birds collected by him during his connection with the North American Exploring Expedition, the scientific value of which can hardly be overrated. . . . . The Committee refer with great pleasure to Captain Blakiston as an instance of a scientific collector who has done service to ornithology; several eggs, for example, obtained by that officer having, prior to his discovery, been quite unknown. Duplicates of some of the rarer ones have been forwarded to the Smithsonian Institution for insertion in the work now being published by them on the Oology of North America."

In March, 1861, he, with Lieut.-Colonel Sarel, 17th Lancers, Dr. Alfred Barton, and the Reverend S. Schereschewsky, explored the River Yang-Tsze in China for some 960 miles above Hankow, being the first Europeans who travelled in that country under the New Treaty Rights. Their discoveries and adventures are well described in "Five Months on the Yang-Tsze," by T. W. Blakiston, late Capt. R.A. London: Murray, 1862. A book which, owing to the disturbances in China, is just now well worthy of perusal.

Captain Blakiston resided but little in England after leaving the service.

DIARY OF FIXTURES.

NOVEMBER.

Days of the Mth.	Week	
1	S	
2	M	
3	T	
4	W	Lecture at 9 p.m. at R.A.I., by Captain W. L. White, R.A., on Okehampton Practice, 1891, to be followed by a discussion.
5	Th	
6	F	
7	S	
8	S	
9	M	
10	T	
11	W	R.A. Band Concert at Woolwich at 3 p.m.
12	Th	
13	F	
14	S	
15	S	
16	M	
17	T	
18	W	R.A. Band Concert at Woolwich at 9 p.m.
19	Th	
20	F	R.A. Band Concert at St. James's Hall at 3 p.m.
21	S	
22	S	
23	M	Lecture at 9 p.m. at R.A. Institution, by T. M. Maguire, Esq., LL.D., on "The Campaigns in Virginia, 1861–65."
24	T	
25	W	R.A. Band Concert at Woolwich at 3 p.m.
26	Th	Manchester Races begin.
27	F	
28	S	
29	S	
30	M	

DECEMBER.

1	T	
2	W	R.A. Band Concert at Woolwich at 9 p.m.
3	Th	
4	F	R.A. Band Concert at St. James's Hall at 3 p.m.
5	S	
6	S	
7	M	
8	T	Lecture at 9 p.m. at R.A. Institution, by Lieut.-Col. N. L. Walford, R.A., on "Artillery Practice in Switzerland."
9	W	R.A. Band Concert at Woolwich at 3 p.m.
10	Th	
11	F	
12	S	

Days of the Mth.	Week	DECEMBER.—*Continued.*
13	**S**	
14	M	
15	T	
16	W	R.A. Band Concert at Woolwich at 3 p.m.
17	Th	
18	F	
19	S	
20	**S**	
21	M	
22	T	
23	W	
24	Th	
25	F	Christmas Day.
26	S	Boxing Day.
27	**S**	
28	M	
29	T	
30	W	
31	Th	
		JANUARY.
1	F	
2	S	
3	**S**	
4	M	
5	T	
6	W	
7	Th	
8	F	
9	S	
10	**S**	
11	M	
12	T	
13	W	
14	Th	
15	F	
16	S	
17	**S**	
18	M	
19	T	
20	W	
21	Th	
22	F	
23	S	
24	**S**	
25	M	
26	T	
27	W	
28	Th	
29	F	
30	S	
31	**S**	

PRÉCIS

AND

TRANSLATIONS.

"ARCHIV FÜR DIE ARTILLERIE UND INGENIEUR-OFFIZIERE DES DEUTSCHEN REICHSHEERES."

FEBRUARY, 1891.

ARE THERE NO LONGER ANY USES FOR SMOKE-GIVING POWDER?

FROM THE GERMAN OF

A. DITTRICH, CAPTAIN, Royal Landwehr.

TRANSLATED BY

Captain R. M. B. F. Kelly, R.A.

It is impossible as yet to measure in any way the effect that the use of smokeless[1] powder may produce on tactics and military science. Whether the smokeless powder is also a noiseless powder appears of secondary importance. It is sufficient to know that a smokeless powder exists, and is already being experimented upon or has been introduced in most armies.

It is a factor which must be reckoned with, although tacticians are not yet agreed upon the dispositions which will enable them to derive the fullest benefit from the advantages of this invention and to minimise the disadvantages to the greatest extent. The universal introduction of this powder is assured, and even those States which have not as yet decided on its adoption, dare not delay its introduction much longer.

The necessity in this case is more urgent than in the case of any advance made in military inventions during the course of the present century. An army which did not, or does not, possess any percussion or rifled arms, breech-loaders, or magazine rifles, if opposed to troops equipped with these arms would not perhaps find itself at such disadvantage as an army with the old powder against opponents provided with smokeless powder. However, so much has been written by the highest authorities on this subject that any further discussion here appears superfluous. On the other hand, the question whether, after the introduction of smokeless powder, the old-fashioned powder will have become quite unnecessary and obsolete, as many maintain, has so far been very little, if at all, discussed.

This question is not so easily answered; it puts one in mind of the time when

[1] Ranchschwache is rendered smokeless as we have no single word to express it, and apparently erroneously name all powders giving little smoke "smokeless powders."

it was thought possible to replace gunpowder by gun-cotton. In a pamphlet written nearly 30 years ago in favour of gun-cotton ("Gun-cotton and its Imperfections," by A. Rutzky and Von Grahl, Vienna, 1863) it was remarked:—"It is a fact proved by the history and development of this world that the old as soon as it is used out must give place to the new and better." "When the artillery have the chance of profiting by the unfettered human intelligence of the present day, should they bewail the necessity of replacing the black compound discovered by the alchemists of the Middle Ages by a more perfect explosive, because the former has heretofore done its work for it? Certainly not!"

And the authors, founding their arguments on further similies, declared themselves in favour of discarding gunpowder, and of the exclusive use of gun-cotton. That gun-cotton did not carry the day is a well-known fact.

A similar case now lies before us, yet the above quoted words cannot be applied any more reasonably than in the former case. Assuredly the smokeless powder is a better explosive than the ordinary powder, but the latter has in no way been fully played out, but still possesses a many-sided usefulness, nay, under certain conditions many advantages over the other which are in no way to be despised. The exclusive adoption of smokeless powder would often cause the other to be sorely missed.

With regard to infantry the question whether the old powder has become obsolete should almost unconditionally be answered in the affirmative. The superiority of the new explosive is here most clearly marked. One has only to recall the street fighting in 1848 and 1849, when the insurgents frequently fired with gun-cotton. The troops that were attacked could hardly ascertain the whereabouts of these antagonists and scarcely inflicted any damage at all on them. A section of infantry firing with smoke-giving powder, if opposed to troops equipped with the new explosive would find themselves in a very evil plight. Even when they had become aware of the position of the troops using smokeless powder, the object would soon be obscured from them by their own fire, and they would themselves be pelted with bullets from the enemy, who would only have to aim at the lower part of the smoke cloud.

Very recently the demands for the use of the old powder in certain cases (and hence the keeping up of both kinds of powders) have waxed very loud.

There may be cases in which the use of the old powder would yield advantages, but such cases would be rather rare, and even when they did occur one would rather try to obtain the desired object by other means.

So would the much talked of English "smoke attack," (at least in the most critical case) not be put on the stage by the use of a smoke-giving powder, but by the help of taper-shaped smoke compositions. And when the Russian regulations recommend the creation of a thick cloud of smoke by means of mass firing in order to cover a retreat, they are evidently framed with the idea of paralysing the advantages of the smokeless powder used by the enemy, which they have been as yet unable or unwilling to adopt.

The similar proposals in the French army remind one of the injunction, highly prized after 1859, but either neglected or followed with disastrous results in 1870. "The all-concealing cloud of Zouaves, under cover of which the main troops hurled themselves unexpectedly on the ruins of the discomfited foe." A German writer remarked at the time that a quiet and well-directed fire would render it possible for the foe "to hurl himself on the ruins of the Zouaves," and it still remains an open question whether the opponent would allow himself to be deceived by the cloud of smoke raised in front of him.

There may, we repeat, be cases in which it would be desirable to have at hand the old or perhaps, another powder. But how can this desire be fulfilled, and should a few men in each company be exclusively armed with a special powder, or each man be provided with cartridges of a different pattern? Since it is quite possible that there would soon arise a necessity for still other different

kinds of powder, there would then be a nice assortment of different patterns of cartridge, smoky, smokeless, noisy, &c. The equipment of a few men with a powder to be used only in exceptional cases would be impracticable, for they would for the most part be mere idle spectators of the fight, and an untimely use of their ammunition might not be preventible. If each man were to be given cartridges of different descriptions, the most terrible confusion and muddle would be unavoidable, and in most cases the opposite of what was desired would be attained. The smoke or vapour, whenever it may be desirable to create it, must be obtained in the English fashion, but, indeed, it is difficult to believe that the " smoke attack " was ever seriously intended.

And for the purposes of a really unmistakeable signal shot other ways can be found. With regard to this it should be noticed that every smokeless powder is not at the same time noiseless, for example the Austrian smokeless powder gives a sharp sound not easily confused with any other noise.

The use of the old powder will, therefore, henceforward be restricted to the blank cartridges fired on gala occasions, the blank cartridges for field manœuvres will have to be filled with the new powder, and only if the " energy " of the two kinds of powder were exactly the same, could the stores of the old powder be used up for target practice.

With the artillery it is rather a different matter. No doubt it is also a tremendous advantage for Field Artillery not to be prevented from laying by the smoke of their own guns, and they must pay for it by the corresponding disadvantage of the difficulty of discovering a hostile artillery who are also firing smokeless powder. But there may be cases in which the evolution of a thick cloud of smoke would be of special advantage.

For instance, the hostile artillery has ranged itself perfectly, and is carrying on a most destructive fire. It is at last desired to withdraw, or to take up another position unnoticed, or at least to hide for a time the evil plight of the battery from the enemy.

A few rounds from the battery, and a sharp lively fire from a proportion of the guns would soon veil it in a thick cloud of smoke and conceal the fact from the enemy that the remaining guns were carrying out a change of position, or that only one half of the guns were still in action. Or it might be of especial importance to the General Officer Commanding-in-Chief to know whether the artillery of one or the other wing, or of a corps sent against the enemy's flank, were effectively engaged. The field telegraph, perhaps, had not been able to establish itself, and gallopers would bring the news a great deal too late. A few shots with smoky powder would give the desired intelligence at once. If the hostile artillery had ranged themselves the uprising columns of smoke would not betray the position any more. However, as a precaution, the pre-arranged signal shots could be given by some guns stationed at another point, by which means the opponent might possibly be deceived for a few minutes as to the real position of the guns. In other cases also guns fired with smoky powder would be the best and simplest kind of signal to give, and this also is the only powder that could in reason be used for saluting purposes.

In the Field Artillery there are no drawbacks to the use of cartridges filled with the old powder. They could be placed in separate partitions in the ammunition wagons, and would only be handed out to the " serving numbers " on receipt of an order from the Commanding Officer. Of course there would only be a small number of such cartridges. Perhaps in most of the foregoing cases some means might be found which would enable the old powder to be dispensed with. But in one case, the latter, as things stand at present, can certainly not be dispensed with. One has only to add some composition to the smokeless powder to make it into a smoky powder, or to use together with it some preparation which will evolve a thick smoke, that would be a more complicated and less reliable solution of the difficulty—but I particularly refer to the bursting charge

of shells, grenades, segment shell, and especially of shrapnel. In the case of percussion shell, as formerly in the case of smooth-bore shot, the point of impact may be observed by the cloud of dust thrown up at the first impact, but when and where the shell burst or whether it was blind could not be determined (at least from the guns) if it was filled with smokeless powder.

But the use of shrapnel, if one does not wish to fire quite at haphazard, becomes of questionable advantage if filled with a bursting charge of smokeless powder. For the little puff on burst is, if not the only, at all events the surest guide as to the effectiveness of the fire, that is to say, as to the correctness of the data—elevation, length of fuze, laying, &c. The use of smokeless powder in this case would most certainly be a grave mistake. Even with the greatest precision in firing, the effect, especially in the case of segment shell, would only be noticed by the enemy in the immediate vicinity of those struck, and the moral effect would thus be very much lessened; although, with equal force, "the uncanny feeling that overpowers troops who find themselves pelted with fragments and bullets from shell that have burst unseen" may fairly be set against that. But, after the introduction of smokeless powder, troops must accustom themselves to shots coming from unknown directions, and no one can deny that the bursting of shell visible and apparent by "smoke and sound," to the front and on all sides makes a deep impression even on seasoned troops. Besides, the use of smoky powder for bursting charges, offers yet this advantage, that a number of shell, bursting almost simultaneously in front of the enemy's line, will give rise to a smoke that will make their aim difficult, and thus tend to diminish one's own losses.

In sieges, perhaps, the old powder may be even more often used.

With quick-firing guns the use of smokeless powder is clearly indicated, for the sake of the ease in laying. Also in the case of guns not under cover when it is desired to open fire unexpectedly, for by its help the enemy will be kept in uncertainty, at least for a time, as to the direction from which the shells are coming. However, even under the most favourable circumstances, this will only be possible for a very short time and by various means, such as captive balloons, for example, both sides will be able to obtain accurate information as to the positions of their opponents' guns. With heavy guns, when they are protected by armoured carriages or in armoured towers, there can be no disadvantage in the use of strong smoke-giving, or ordinary powder if it has the same energy as the new powder—for in the slow firing that will usually be the rule from these guns there will be sufficient time between the shots for the smoke to clear away so that it will be no hindrance in laying.

Besides the uses of smoky powder from a part of the guns will tend to deceive the enemy and admit of an effective fire being carried on even from guns in the open. Such a case would be possible if, for instance, two guns fairly distant from each other, one of which was protected and the other in the open, fired as far as possible simultaneously, even if their objective was different. The enemy, only paying attention to the smoke issuing from the armoured tower, would for a long time direct his fire only at this protected position, whilst he would himself suffer perceptible loss from the unprotected, but unobserved gun.

Evidently what has been said about the bursting charges of shell and shrapnel of field guns applies with equal force to those of fortress and siege guns. It is of the greatest importance to know whether the shells fired against the enemy's breastworks and walls have burst after penetration or not, a fact that can be easily ascertained by the use of smoky powder as bursting charge. The brownish yellow or reddish cloud of dust (according as to whether the earth or the escarp was struck) will be tinged white by the use of the old-fashioned powder, which would not be the case had smokeless powder been used. For the sound, even if very loud, cannot, if there is the slightest attempt at a bombardment going on, give the necessary indication, as it would be impossible to know to which shot any particular detonation belonged.

With these guns also the ordinary powder may, or rather must be, used for saluting and alarm shots. For the smokeless powder appears little, if at all adapted to these purposes.

Also the old powder can very often be used for the practice of Fortress Artillery.

On the other hand, the use of smokeless powder will be the rule with Coast Artillery, and, finally, will only be kept for use as bursting and saluting charges. It will always be an advantage to the defenders if the ships steaming past or up are in uncertainty as to the direction from which they are being fired on, or as to which batteries are maintaining the liveliest fire. For in most cases it will not be a matter of a long continued, but of a short and lively fire from the Coast Batteries, of the most accurately aimed shots from each single gun, and the importance of this increases with the size of the gun and the costliness of its ammunition. The huge calibres of coast guns develop such a thick smoke that even with slow firing the exact laying of the next round is rendered very difficult, but with rapid firing any aiming will be rendered almost impossible, for after a few rounds the battery would be enveloped in a thick smoke, and when a clear out-look was next obtainable the hostile ships would probably have changed their position, and the guns of the battery would have to be ranged anew, whilst the battery itself would be under a heavy fire from the ships' guns (to which the cloud of smoke hanging in front of the battery offers a convenient mark) all the time, even when the ships were in motion.

It is the same with naval guns. Here especially the quick-firing guns require the exclusive use of smokeless powder. With regard to the smoke from the guns obscuring or completely concealing the object, especially in the case of fire from very big guns, the same remarks hold good as in the case of Coast Artillery. Here also will it chiefly be a matter of a short, but rapid and very well directed fire, so that the use of smokeless powder appears all the more indicated in this instance. The fire should consist of a few rapid well-aimed shots, from guns of big calibre, a thing that would be quite impossible with the old smoky powder. A ship in motion may escape from the surrounding cloud of smoke, but the smoke that will cling to the interior of a ship must be thought of. This is of slight importance in turret ships, those with guns in protected barbettes, and armoured ships, but in the batteries of frigates and armoured corvettes, the smoke after a few broadsides used to be so thick that for a short time the crew were not able to serve their guns. A lively and well-sustained fire from these batteries would only be possible by the use of smokeless powder, provided that no unhealthy gas was developed by the burning of this new explosive. Such gases were observed in some of the patterns of smokeless powder formerly experimented with, and this was of great importance to all guns mounted in covered emplacements.

On the other hand, there are also cases in which the development of a thick cloud of smoke would be of especial advantage to a ship. It might be possible by means of it to deceive the enemy—if only for a few minutes—as to a change of position, or at least as to the preparations for the same, whether done with the object of withdrawing oneself from an overwhelming fire or of deceiving the enemy. Besides in calm and rainy whether (which brings down the smoke) such a thick cloud of smoke would hang in front of the ship after a very few rounds that it would remain completely veiled, and invisible for a long time. This would be much more easily the case with the modern armoured ships than with the lofty and tall-masted frigates and line-of-battle ships, whose topgallants, at least, soared above the smoke. In the battle of Lissa, even at the first onslaught, the "ramming" planned by Von Tegetthoff could not be carried out on account of the thick smoke (as fire was opened at once from both sides), and also during the progress of the fight it repeatedly occurred that the Austrian ships, steering straight for the enemy's ship opposite to them with the intention of ramming, were met with a full broadside, and as soon as they had passed through the

smoke they found the opponent in another position, and had themselves to turn, either to avoid being rammed, or to get a fresh run to ram the enemy.

For saluting and signal shots, which play a great part in naval affairs and require a considerable amount of powder, the ordinary powder would also be used. Not only because it is more suited for those purposes, but also for the sake of economy as all the smokeless powders that have been produced so far are far-and-away more expensive than the ordinary powder.

On the other hand, in this instance smokeless powder might be used in exceptional cases for the bursting charges of shell. Shell that had penetrated the skin of a ship, would, if filled with smokeless powder, very likely pass unnoticed by the crew, and so, like those mischievous red-hot shot once so dreaded by sailors, their penetration would first be noticed when the flames began to burst forth from the sides of the ship. Also the bursting of several large shell, filled with the ordinary powder, on and in the walls of a ship, would produce such a thick smoke that after a time an exact aim on some particular spot would be impossible. And in close quarter fighting it may often be necessary to hit one particular spot.

One has only to recall to mind the concentrated broadsides of Admiral Tegetthoff, which, although only fired from smooth-bores made such holes in the enemy's armour plates that the Italians imagined they had been struck by shell from guns of enormous calibre. In the same way the Austrian Coast Artillerymen fired shot after shot of their round shot and shell, into the port-holes of the "Formadabile" and the other hostile armoured frigates which had penetrated into the harbour of Lissa, and obliged them to decamp. Again, in the war between Brazil and Paraguay, the Brazilian armoured ships going down the Parana suffered a considerable amount of injury and annoyance for this reason, that the Paraguayans directed their very small guns on the enemy's port-holes, and as they repeatedly struck the same spot they even occasionally succeeded in shattering an armour plate. But this requires a very accurate aim, which would be difficult if the shells were filled with the ordinary powder, especially if the fire was "rapid." Besides the usually so important observation of the burst of a shell is not so difficult at close quarters even with smokeless powder, and is also not necessary for "ranging" purposes.

In all the foregoing no argument has been brought against the introduction and use of smokeless powder. The advantages which speak in favour of it are too great to justify any serious opposition—and even where it is not in use it must soon be introduced, for the simple reason that the armies of neighbouring States have adopted it. We have only endeavoured to show that in many instances, and for a long time, the old powder can be used with advantage together with the new explosive, and that, at least at present, it is much to be preferred to the latter, when the attainment of certain particular objects is desired.

The usefulness of the old powder has in no way been played out, and in more ways than one it is still indispensible. And even if that were not the case, but merely that in certain cases there would be no disadvantage in the use of the old powder, still, having regard to the costliness of the new explosive and the enormous stores of the old powder, the latter would have to be used whenever and as often as possible. Also the extraordinary demands which the maintenance of an army makes on the financial power of a State, in order to keep up with the advances in military *matériel*, and to prevent one's own nation being surpassed by one's neighbours must be borne in mind, so that it is of the greatest advantage to the financier as well as to the soldier, when old *matériel* can be most advantageously used up and thus new *matériel* saved, especially when this can be done as easily and without the slightest disadvantage, as in the instances given above.

SIMLA,
26th June, 1891.

"REVUE MILITAIRE DE L'ETRANGER."

DECEMBER, 1889—JUNE, 1890.

"THE ARTILLERY COMBAT IN SIEGE WARFARE."

(ACCORDING TO THE THEORIES OF GENERAL WIEBE.)

BY

LIEUT.-COLONEL J. H. G. BROWNE, LATE R.A.

(Continued from No. 12, Vol. XVIII.)

THE ARTILLERY "RÔLE" DURING THE SIEGE.

IT has been seen that General Wiebe admits the necessity of forming in each fortified place a special reserve of guns intended to reinforce those of the covering armament, which are too few in number to prevent the enemy from establishing his line of investment. This special reserve might, however, be more accurately described as a "complementary armament." The General proposes to employ it in the following manner. The special reserve should be placed outside the forts, because it would be too much exposed inside, and also would be cramped for space, whereas in the intervals of the forts it would find the space required for deployment and for opposing the enemy with some chance of success. This is certainly an excellent principle, and the broad distinction drawn by General Wiebe between the guns of the forts and those of the intervals is quite in accordance with the requirements of modern warfare. The artillery of the forts should on no account be increased beyond what is strictly necessary. The only guns which should be placed there are those which will be required to act before the siege batteries open fire, or to repulse attacks by open force; all the others should be placed outside in carefully selected positions, and organised like siege batteries. The defence has a great advantage in being able to prepare beforehand the disposition of its artillery, but the exigencies of the moment may sometimes necessitate the redistribution of these guns in the intervals between the forts. This difficulty, however, will be easily overcome, if care has been taken to include in the special reserve some pieces which may be utilised to fill up the gaps in the line of battle. This dispersion of the guns between the forts makes the service of the batteries somewhat difficult. The control of the fire, supply of ammunition, &c., will be much more complicated than if all the artillery were concentrated in the interior of the forts. But this is a difficulty which must be foreseen and studied in time of peace.

The ideas recommended by General Wiebe, with regard to placing guns outside the permanent works, meet one of General von Sauer's principal arguments to prove the advantages of the attack over the defence. Indeed, von Sauer's

methods of attack are principally founded upon the bad situation of the artillery in the forts. If these guns are placed in the intervals in batteries like those of the besiegers, the two adversaries will meet on equal terms, or possibly on terms advantageous to the defenders. But, as has just been said, this dispersion of guns necessitates special dispositions for the service of ammunition. General Wiebe thinks that it would be a mistake to keep the ammunition for the batteries of the intervals inside the permanent works. Small expense magazines should be made behind the batteries, taking every precaution to conceal them from the view and fire of the enemy.

Whilst holding the first siege batteries in check, the defenders should soon recognise the fronts against which the besiegers will direct their principal attacks; and should not then hesitate to begin the work necessary to complete their protection. Without waiting for the enemy to open fire they will at once bring up part of the guns of the general reserve and make emplacements for them in case of need. Some of these may not be wanted, but it is better to have too many than too few.

General Wiebe considers it impossible to lay down any rules with regard to the proportions of these guns to be brought into line and to be held back in reserve. It depends upon the reliance which can be placed on the information obtained as to the enemy's plans.

As a matter of fact, the defenders are always liable to be deceived with regard to the enemy's intentions, and to bring up guns on a front which will not be attacked, exposing that really threatened. A mistake of this kind would be much less important if the Garrison Artillery were more portable, and General Wiebe considers that this would be the obvious place for the light howitzer, whose creation he advocates.

"In some cases," he says, "the light howitzers, which we intend especially to take part in the decisive combat, would be very useful at the very beginning of the struggle, because, thanks to their mobility, they could be brought up rapidly and in great numbers upon any points when immediate reinforcement is required. In such cases it would be their part to restore the equilibrium of fire, momentarily interrupted, until more powerful pieces can gradually come up to replace them."

We see that, according to General Wiebe the defenders should reply, stroke for stroke almost, to their assailants, and would be wrong in husbanding their resources for the final struggle. As soon as an enemy's battery opens fire, they should, if possible, oppose it with a superior number of pieces.

This principle at first sight seems to be in opposition to that of Vauban, who thought that the defenders should not reply to the first batteries of the attack, which were too far away to be really dangerous, and that they should reserve their fire until after the opening of the second parallel. But this principle is not really applicable to the present day because, with modern artillery, the first batteries of the attack will, in spite of their distance, produce such effect that an attempt must be made to silence them. But Vauban's real principle, which was to avoid wasting ammunition, is just as good at the present day as it was formerly.

The Artillery Combat.

Whilst the besiegers carry out the different operations described above they deploy before the front to be attacked the heavy guns intended for the artillery combat. The use of the word "deploy" once more emphasises the similarity, which General Wiebe admits, between the attack of a fortress and a battle in the open; as soon as these "batteries of introduction" open fire, the artillery combat commences.

To prevent confusion, it must be remembered that General Wiebe has here in view two sorts of batteries. The first, which he calls "batteries of preparation,"

are intended to prepare for and cover the deployment of the second, called "batteries of introduction," because they begin the struggle with the defending artillery.

But, as has already been said, the deployment of these batteries is a very delicate operation. To be successful it must be carried out by surprise, taking advantage of ground and of the cover of night, and avoiding everything which might attract the enemy's attention. Thus it would be unwise to draw in the line of investment at the moment when the construction of these batteries is contemplated with a view to covering the working parties better, because there would be a danger of attracting the attention of the garrison and of enabling them to make their dispositions accordingly. The line of investment should be traced so as to render such a movement unnecessary. As soon as the "batteries of preparation" have done their work, fire should be opened simultaneously along the whole line; otherwise the element of surprise would be lost.

When the combat has once been entered into, the fire of most of the guns should be concentrated upon the real front of attack. Dispersion should be avoided, and all the batteries which cannot take part in the combat should be dismounted, including, except under very special circumstances, all those used for false attacks.

The "batteries of introduction" will fire on all the defending guns, but especially on those which are most troublesome, replying slowly to the others. The besiegers will not hesitate to bring up reinforcements to any points which may seem to require it.

General Wiebe again recommends that the besiegers should try to turn the enemy's flanks, but admits the difficulty of the operation, especially in the case of large fortresses of great radius. This idea has been discussed in a previous article, but the General here offers some new considerations which may be worth noticing.

He considers that the besiegers would be quite wrong in unduly extending their front of attack, under the idea of turning the enemy's flanks, or of preserving their own from a similar danger. The extremities of their line must always be exposed to the attacks of neighbouring works, unless they actually invest the whole fortress; an absurd idea not worth discussing. The only judicious course is to restrict the front on which the batteries are deployed as much as possible at first, as the flanks are sure to be sufficiently extended in the course of the siege. The minimum length required for this purpose would be about equal to that of the portion of the enemy's position, which it would be necessary to occupy in order to make an assault upon the central main-work of the fortress. With the large intervals which now separate the detached works of a large fortress, the first front of attack might probably be limited to one fort with its two lateral intervals. The line of batteries would thus follow the arc of a circle corresponding to that of the fortress. The flanks of this line will not be pushed forwards, but on the contrary slightly refused, in order to fire directly on the faces of the two collateral forts which command the ground attacked. These flanks should be vigorously supported by the batteries of preparation which are best situated for the purpose and would not generally be extended beyond the capitals of the collateral works, as otherwise they would be too much exposed to the fire of the neighbouring intervals.

These are the dispositions recommended by prudence, and General Wiebe does not hesitate to declare them necessary, although they render difficult the envelopment of the flanks of the front of attack, previously laid down as one of the conditions of success. But the General is right, and his opinions are all the more welcome because at the present time we are tempted to forget all prudence in the attack of fortresses. Certain authors, headed by General von Sauer, have promulgated such audacious theories on this subject, that we cannot feel surprised

that General Wiebe should present the operations of a siege in a light less favourable to the attack, and should recommend a somewhat less rash conduct of the latter.

The complete difference between the methods of attack recommended by the two German Generals is here very apparent. General von Sauer insists that the line of forts should be attacked on several sides at once, or even on all sides in making a sudden attack. General Wiebe, on the other hand, concentrates his forces instead of extending them, drawing in his front as much as possible, in order to produce crushing effect upon one particular point. The latter method would appear to be the most conformable to tactical rules, although it is possible that General Wiebe goes too far, and that his attack would not be developed sufficiently. This point will be examined further on, but theoretically his method is less risky than that of General von Sauer.

The besiegers, however, expose themselves to a serious danger when they reduce the extent of their line of batteries too much. If, underrating the resources of the fortress, they bring too few pieces into action at the beginning of the artillery combat, they lay themselves open to a serious check. General Brialmont, treating of this subject in the "Fortification du temps présent," says :—"In the German military schools they recommend a plan of attack of a large fortress with detached forts, which requires a siege-park of 400 pieces. Of these 400 pieces 344 are in line, the rest forming the reserve. This siege-park is not sufficient to produce the great moral and material effect which ought to be aimed at on the first opening of fire."

"For the defenders can mount, in each interval of 3000 metres, 20 provisional batteries of six pieces, which would act simultaneously with two attached batteries (12 pieces), an intermediate battery (six pieces), and two demi-fronts of of the forts mounting 14 pieces. The besiegers, therefore, on the day of opening fire would have, with only 344 pieces, to engage 3 × 152 or 456 pieces. They would then certainly meet with the same fate as the French did on the 17th October, 1854, when they opened fire before Sebastopol with 53 pieces, to which General Todleben opposed 64. After an engagement of four-and-a-half hours the French batteries were reduced to silence, whilst the 72 English pieces, better grouped and of larger calibre, overpowered the Russian pieces, which were of medium calibre and only numbered 54."

"The Allies, who on that day could only bring 125 pieces into action, were obliged at the end of the siege to raise the number to 806, in order to obtain a superiority of fire."

It must also be remarked that General Wiebe's ideas differ considerably from those which are now taught in the German military schools, and from those which General Brialmont expresses in the quotation above. He lays down that the front of attack should be limited to one fort with the two adjacent intervals, and, as a matter of course, the two collateral demi-fronts of forts. Allowing three kilometres for the intervals, it follows that the siege batteries will occupy a space of about six kilometres. The method recommended in Germany consists in attacking first two forts and three intervals, with two collateral demi-fronts; which would give a length of about nine kilometres to the line of batteries. The difference of three kilometres is not to be neglected. This subject will be referred to later on.

As soon as the besiegers begin the artillery combat, the defenders should at once reply with all the guns available, which should be immediately reinforced, either from the general reserve or from the armament of the fronts which are not attacked. It is very important that all the siege batteries should be replied to at the same time and in an effective manner. At first the defenders will probably find some difficulty in directing their fire, because their arrangements are incomplete and they do not know the exact distribution of the enemy's forces. But

this state of uncertainty should last a very short time ; the position and, if necessary, the distribution of the armament, must be altered so as to meet the enemy, and even prepare for his defeat.

The turning movements which the General considers dangerous for the besiegers, are not, in his view, out of reach of the defenders. On the contrary, nothing prevents the latter from pushing groups of batteries forwards under the protection of the neighbouring forts so as to take the enemy in flank ; having previously sent infantry to clear the ground, and drive back any of the enemy's posts which might interfere with the construction and service of the batteries.

It will, perhaps, be objected that the guns thus pushed forward to take the enemy in flank may be themselves enfiladed by the besiegers. This danger is not really very serious, because the batteries of the attack, as has been seen above, occupy a restricted front at this period of the siege, and have their flanks thrown back. The defenders may, however, provide against this contingency by using light and portable guns for these batteries which can easily be withdrawn if necessary ; having at any rate forced the enemy to extend his line more than he intended. If, from the beginning of the struggle, the superiority of the siege batteries is so marked that the defending artillery finds it impossible to continue its fire, the defenders must at once abandon their position and take up another in rear where they can recommence the combat under more favourable circumstances. This, however, is an exceptional case ; as a rule the combat will be continued and carried out upon the ground first occupied. It does not, however, follow that all the pieces belonging to the defensive armament take part in the artillery combat. Some of them will be left to their special destination, such as the field guns, which only accompany the infantry in their sorties, and otherwise are kept under cover, and also those which have been in action during the period of preparation of the siege, but which are too badly placed or too insufficiently covered to take part in the artillery combat. These however, should be either transported to better positions or reserved for ulterior employment.

To this last category belong the heavy guns of the forts which are not attacked and the whole of the pieces of the attacked fort. None of these should be allowed to remain idle, but they should be brought up towards the front of attack and formed into a strong reserve, ready to come into action as soon as the period of execution begins. The besiegers cannot do better than throw up the works necessary for these guns without delay, as the term " reserve " here, as elsewhere, should not be taken in its literal sense. As soon as these works are finished and the guns ready to fire, the artillery combat will enter into the " period of execution."

Generally speaking, the besiegers will be first ready, especially if the deployment of their batteries of introduction is carried out under the usual conditions. Indeed, the position would be seriously compromised if the defenders took vigorous offensive action, and surprised him with his preparations incomplete. But this would be an exceptional case, as the besieger has the initiative in the attack.

General Wiebe says that, during this period of execution, the infantry will advance towards the place under cover of the batteries of " introduction," and even of the batteries of " preparation " which have already fired, and will clear the ground of the enemy for a sufficient extent to enable the artillery to approach the works and augment the effect of its fire.

This further approach is indispensable, because the batteries of " introduction " are too distant to reduce the guns of the place to silence, or could only do so with an inadmissible expense of time and ammunition. This should be the business of the " batteries of execution." But this operation, even when well prepared and carried out, is very dangerous and costly ; everything depends upon the manner in which the batteries of preparation have done their work. The

besiegers can only succeed by making use of such powerful forces that, even after suffering considerable losses during the deployment, they will have a sufficient number of guns in firing order to be certain of victory. They will be especially careful to construct their batteries with rapidity and without attracting their enemy's attention ; lastly, they will only employ shell guns or mortars of medium calibre, which are sufficiently portable and yet will produce considerable effect. Even after a successful deployment, these batteries will have great difficulty in keeping up the contest unless their flanks are carefully guarded. The nearer they approach to the enemy the more easily will their flanks be turned, and the support of the batteries of introduction will not be sufficient, especially if the defenders construct some counter batteries in front of the collateral forts. Consequently, as the Siege Artillery advances towards the works, vigorous action should be taken towards the flanks either by direct attack or by turning movements, in order to silence all the guns which might take the principal attack in flank. Easily-manœuvred pieces, such as shell guns and mortars of medium calibre, should be used for this purpose, supported by heavy batteries échelonedin rear.

Lastly, to prevent any mistake, the batteries of introduction, at any rate those which are not masked, will continue their fire. They will be a powerful support to the batteries of execution, and need not change their position, which, with such heavy guns would be hardly practicable.

As usual, General Wiebe does not specify any precise number of guns which the besiegers should put into line at this period. He confines himself to laying down general principles. "The very nature of the artillery combat before a fortified place," he says, "requires that the besiegers should, during this period, only employ on the front of attack the number of pieces strictly necessary to hold their own with the defenders. They will endeavour, by powerful concentrations of fire on the most favourable points, to exhaust the enemy's forces until he finds it impossible to continue the struggle. As soon as this period arrives, the artillery combat passes into the period of 'decision.'"

The General's idea then is, that during the period of execution the besiegers should endeavour, not only to increase the losses already sustained by the enemy and to diminish his means of action, but also to prepare the way for the decisive combat by gaining possession of the ground required for the deployment of the pieces held in reserve for this last period. The means proposed with regard to this object will occasion surprise, and in order not to misrepresent the author, a literal translation of the German text is here given:—"To attain the object which has just been set before us," he says, "it is necessary first to reduce to silence the guns of one of the collateral forts and the batteries which adjoin it, and then to take possession of this fort itself, for this work, even though it may be only a mass of ruins, may still be well defended by infantry, and may considerably interfere with the turning movement against the flank of the principal portion of the defence. Consequently, in addition to the batteries intended to act against the flanking positions occupied by the enemy, the assailants should construct others specially for the attack of the collateral fort. When the latter have produced their effect the time will have come to push forward the infantry and pioneers, who, in conjunction with the artillery, will gain possession of the fort as soon as circumstances permit. In this way the beginning of the decisive combat, which ought to be marked by the deployment of the guns intended for the enveloping attack, will not be put off longer than necessary. In fact, there is always a fear that the defenders will find a favourable opportunity to withdraw their artillery from the destruction which threatens it, will organise a position further in rear, and thus oblige the assailants to pass again through all the phases of a new combat."

This subject will be alluded to again.

The author goes on to say that it will not always be necessary to take one of the collateral forts, because if the attack has been vigorously conducted during the period of execution the artillery of the place may be silenced, and the fort in the centre of the front of attack may be captured by assault. In this case the "decisive combat," that is to say the envelopment of one of the enemy's flanks by the Siege Artillery, which, according to General Wiebe is characteristic of this combat, will not take place. The besiegers should aim at this desirable result, by taking advantage of any weakness on the part of the enemy to push forwards as rapidly as possible towards the front of attack.

But they must expect to see all their movements watched and thwarted by the garrison. Following the great example of Sebastopol, the General advises the defenders to lose no opportunity of taking the offensive whenever circumstances appear favourable. But the peculiar and original part of his theories is that almost all the proceedings recommended for the attack are, according to him, equally applicable for the defence. For some years past, especially since the introduction of very powerful projectiles into siege-parks, it has been the fashion to consider the defence as in an almost hopeless condition. The most remarkable example of this way of looking at the question is to be found in the works of General von Sauer, and especially in the last, entitled "Sudden attacks against fortified places, and the method of repulsing them," in which the first part, relating to the attack, gives all the information necessary; while the second part, relating to the defence, is so short and unsatisfactory that one feels that the author has no confidence in his own precepts, and believes that any fortress which is attacked in the way he recommends must necessarily be taken.

General Wiebe does not fall into a similar exaggeration, he believes that prolonged resistance is always possible. Without doubt the fortress must capitulate in the end, but, if the Commandant knows his duties, he can make the assailants pay very dearly for their victory, and cause a very serious delay, if not an absolute check, in the forward march.

It may then easily be admitted, in accordance with General Wiebe's ideas, that the defence should follow the same principles as the attack, and should endeavour to hold the enemy fast in front while making a turning movement against one of his flanks, the execution of this movement being supported by one of the collateral forts. But although such a flank attack might probably bring about the important results which the General expects, the manner in which it is to be conducted is certainly open to criticism. This will be shown directly.

The author goes on to say that the conduct of the defenders will be the same whether they intend to preserve a defensive attitude, to prepare an offensive movement, or to retire from their first position to one nearer to the place.

They will bring up a sufficient number of pieces to prevent the enemy from gaining ground, and will endeavour to crush the most annoying of the siege batteries by a concentric fire. In front of and around the collateral forts they will place counter-batteries to contain the flanks of the besiegers and prevent them from advancing. They will also construct batteries a little in rear of these forts to protect them against any attempt at direct attack. After their fall these batteries will contest possession of the ground which the besiegers require in order to deploy for the decisive attack. If these dispositions are taken in time the General considers that victory may be obtained by a wise economy of forces where practicable, by fighting to the last at the points where the enemy may be long held in check, by following his movements and profiting by his faults.

There is no doubt that the period of execution may last a long time, and as long as neither of the adversaries shows signs of exhaustion no decisive results can be expected; everything depends upon their resources. But eventually the situation will change; resources and material are not inexhaustible, especially on the side of the garrison, and even the highest state of 'moral' will eventually deteriorate. Then the two sides should endeavour to estimate, as accurately as

possible, their respective positions, and see if the moment has not arrived when a final blow may be struck at a shaken adversary.

According to General Wiebe this estimate is difficult to make, because it is easy to be deceived in the extent of the enemy's exhaustion. Even the slackening of fire is not a sure indication, as it may be voluntary and temporary, with a view to deceiving the enemy or from some other cause. Errors are certainly to be feared, but it is doubtful whether the General is right in saying that they are equally probable in either direction, that is to say that the enemy's moral and material position is as likely to be over-estimated as the reverse. Is there not a natural tendency in the besieged to exaggerate the forces of the besiegers, and *vice versâ*? Does not this frequently happen? General Wiebe might have done better if he had admitted this distinction, but he has not done so. He continues his deductions as follows :—" If we believe the enemy to be more shaken than he is, we shall encounter an unexpected resistance, and, perhaps, even be exposed to an offensive return on his part; consequently it will be necessary to have at hand the means of guarding against this danger, which might place everything in jeopardy. If, on the other hand, his situation is judged of too favourably, no serious disadvantage will follow, and advantage may be taken of the fact to push on the final operations as vigorously as possible, so as to hurry on the " *dénouement.*"

As has been said above, under certain favourable circumstances the enemy may be defeated during the period of execution; but, adds the author, unless it is certain that the resisting strength and resources of the enemy are exhausted, an enveloping attack round one flank will be the surest means of obtaining victory. This principle is correct in theory, but it seems very difficult to apply it to siege warfare, and General Wiebe goes too far in trying to assimilate the operations in an open country to those of the attack of a fortress. As will be seen, the explanations which follow do not reply to the numerous objections which can be raised to the adoption of this principle.

The first condition necessary for success in the enveloping attack is to have the space necessary for working the batteries, and with that object the occupation of one of the collateral forts and the neighbouring ground is an absolute necessity. The second condition is to act by surprise so that the deployment of the artillery may follow immediately upon the capture. The third and most important condition is to open fire simultaneously with a great number of pieces. It has already been seen that, according to General Wiebe, these pieces should be quick-firing and easily manœuvred. There is no reason why they should not be supported by heavier pieces, but the latter should be entirely distinct from those intended for the developing attack.

It is to be expected that the enemy will make every effort to take the attacking batteries in flank or rear, because they can hardly resist them in front. To guard against this danger General Wiebe recommends, first, rapidity of attack, and, secondly, a combination of an attack in front with one in flank, so as to give the enemy no time, distract his attention, and, if possible, oblige him to divide his forces.

Such is, on the principal points, the course which the artillery should pursue during this last period. But, in order to secure the successes obtained by this arm, they should be followed up step by step by the infantry and pioneers, who will rapidly occupy the points in the enemy's line where guns have been dismounted, and will put them in a state of defence.

Lastly, an offensive return on the part of the enemy should always be guarded against, which may create a momentary check or even movement in retreat. In order to minimise the results of such a contingency, a series of defensive positions should be organised during the advance, in order to check such a movement if successful.

Period of Achievement of the Siege.

According to General Wiebe the artillery combat is the most difficult part of the siege—whoever is victorious is certain to gain a complete victory. If the combat has terminated in favour of the besiegers, their artillery will have nothing more to fear from the guns of the defenders, and will be able to apply itself seriously to the work of demolition, which has already been begun during the artillery combat. The infantry and pioneers will naturally have taken advantage of the artillery success to make a trench of some extent opposite the principal position of the defenders, which should now be used to make an advance upon the body of the place. If necessary it should be extended to the flanks, and if the defenders are still in possession of any points from which they may interfere with these ulterior operations, they must be driven from them. All obstacles must be removed which may prevent the infantry from taking up the position which will serve as a point of departure for the attack by sap, and which will cover at the same time the batteries directed against the body of the place.

This infantry position is really nothing but a first parallel, and it would be simpler to call things by their right names, but the General does not like to make use of so obsolete a term, which recalls the time when the engineer department played the principal part in a siege. This is no longer the case, as the attack by sap will not be necessary in the case of the detached forts, and only under certain conditions in the case of the body of the place. The artillery combat is now the principal operation of the siege, the rest being only accessory. This seems to be General Wiebe's real opinion, as, although he devotes some lines to a description of the conduct of the defence during the last days of the siege, it is done in such a laconic manner that the author does not seem to have any great confidence in the efficacy of the means which he recommends.

Before concluding this examination of General Wiebe's theories, it is necessary to retrace our steps in order to discuss some of his statements which are especially noteworthy—and, first, with regard to the division into periods, this is undoubtedly convenient for the study of the operations, but it has the disadvantage of being somewhat arbitrary and of giving an inexact idea of the combat. Is General Wiebe sure that the attack and defence of a fortress will really pass through all these different phases, and are not the distinctions which he makes between batteries of "preparation," of "execution," &c., and between the different kinds of reserves, of a very complicated nature? All the methods of attack hitherto recommended by foreign military authors are much simpler than his, and in that respect are certainly superior, as, in the operations of war, simplicity is one of the conditions of success.

One of the tactical principles upon which General Wiebe most frequently insists is that it is necessary to act quickly and by surprise. This principle is excellent in itself, but would it not sometimes be difficult to follow? We think that the General would have done well to have indicated the means by which he proposes to overcome the obstacles met with in a real siege. It must be assumed that the fortress, under the conditions here considered, will be powerfully armed, and the besiegers will require a considerable park of siege guns, and it is a pity that the General does not give any information on the point, so as to be able to estimate the efforts required on either side. General Brialmont considers that the besiegers will require to bring up to the first artillery position at least 700 guns, howitzers, and mortars. If this be so, the deployment of such an artillery would entail great labour, and it would have been useful to show how the elements of rapidity and surprise could be made compatible with such an undertaking.

The last and at the same time most important observation concerns the method of attack chosen. Everything rests upon the idea that the artillery alone is capable of reducing the line of detached forts, whose resistance will be easily

overcome, especially after they have been played upon for a considerable time by siege batteries. The co-operation of the other arms is only necessary for the actual occupation of the works dismounted by their fire. This is evidently the author's idea, as otherwise his system of attack would be inexplicable. He begins by selecting a narrow front of attack, upon which he accumulates a great number of guns. This front comprises one fort and two intervals. It would naturally have been thought that this fort, as the strongest part of the front, would have required a series of special operations for its reduction. But General Wiebe describes the course of the siege exactly as if the fort had no separate existence, and does not even indicate the time of its capture. This detail, however, should have been noted. Moreover, in order to turn the enemy's position, he talks of capturing one of the collateral forts, so that it almost looks as if, in order to take the fort attacked, it would be necessary first to take one of the neighbouring ones. Here, as in many other passages, some explanation would have been useful.

At all events, the General only attributes a very secondary importance to the detached forts and does not think them capable of any great resistance, and in this opinion he agrees with General von Sauer, whose methods of attack have already been noticed.

But is not this opinion founded upon an exaggerated notion of the destructive power of artillery? For the author of the *Ideen über Befestigungen* has established the fact, which ought not to be lost sight of, that a fort whose artillery has been reduced to silence is still a formidable obstacle, because it can be vigorously defended by infantry, and it is exactly this infantry defence which renders the attack by sap necessary. We hear a great deal, and with reason, of the recent progress of artillery and of the extraordinary effects produced by powerful explosives; but has not the armament of infantry also made progress, and will not the introduction of the magazine rifle render very costly the execution of an attack from a long distance against works whose passive defences are still partially intact? Even if the interior of the fort is untenable, there will be places in the flanks and gorge (as is pointed out by the author of the *Ideen über Befestigungen*), comparatively under cover, where the troops intended to repulse the attacking columns can assemble. On this subject General Brialmont says, "The history of modern sieges shows us how costly it is to assault a fortress without sapping up to the foot of the glacis. The attacks by open force on Ismäil, Badajos, Silistria, Kars, the redoubts of Duppel, the '*enceinte*' of Sebastopol, and the entrenched camps of Plevna, having regard to the circumstances which caused some of them to succeed, others to fail, and caused a great loss of life in all cases, are so conclusive, that no General who is anxious for the life of his soldiers and for his own reputation will wish to follow the example. This sort of attack is less feasible now than formerly, when there were no quick-firing rifled guns, no segment and shrapnel shell, no armour-plating to protect the guns, and no electric appliances to illumine the ground up to a distance of more than 2000 metres."

It is then to be regretted that General Wiebe has not gone more into detail with regard to the means to be employed to gain possession of a detached fort with the rapidity he expects.

It has doubtless been remarked that he makes no allusion to smokeless powder, but this omission is no doubt due to the fact that his essay was written before this question came to the front as a military study.

Although General Wiebe, in his essay, only deals with the artillery combat, we can, in reading it, form an idea of the manner in which, in his opinion, the siege will be conducted. The salient points of his method only have been dwelt upon, so as to enable our readers to compare the method of attack proposed with those which are now recommended in Germany.

(Conclusion).

NOTES

FROM

CORRESPONDING MEMBERS.

The Secretary has a few copies of the new edition of "Kane's List" which were not subscribed for. These are now on sale at £1 each.

Any member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

The Records of the Royal Military Academy are about to be re-published in the original form, with additions and drawings, bringing it up to date; the estimated cost will not exceed 12s. 6d. a copy.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

A new "Kane's List" having been recently published, and progress having been made in collating relationships of R.A. Officers past and present, Officers are requested to notify to the Secretary, R.A.I., any relationship existing between them and any other officer of the same name registered in "Kane's List."

The subject for the Duncan Gold Medal Prize Essay, 1892, is: "Fire discipline; its necessity in a Battery of Horse or Field Artillery, and the best means of securing it.

Attention is called to the Rules for Prize Essays, &c., and Officers are asked to be careful in posting their essay intended for competition in time to reach the Secretary before the 1st of April.

Copies of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

The Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

The Catalogue of Works (Authors' Index) added to the Library from 1882 to present date, is taking longer in the press than was expected, but the application of any member wanting a copy will be noted, the copy sent within a few weeks.

A "Newspaper Cuttings" Book is now placed in the Reading Room of the Institution, in it being pasted from time to time letters and articles of military interest appearing in the daily Papers.

In accordance with a resolution passed by the Committee in February, 1891, sanctioning the printing in these Notes of questions of universal interest with the answers to them, the following point raised by Captain P. de S. Burney, R.A., is inserted.

He states, for the benefit of Adjutants of 16-pr. R.M.L. Position Batteries, that there seems to be an error in the Range Table of the Drill Book, Vol. II, 1889.

First.—Muzzle velocity 1355 f.s., refers to common shell weighing 16 lbs. 1½ ozs., and not to shrapnel shell of 17 lbs. 14½ ozs. This is rectified in the Range Table in "Hand-book for 16-pr., 1891."

Second.—The foot note, which says, "Common shell being lighter than shrapnel, ranges 100 yards further at the same elevation," is theoretically incorrect, and from the practice of the two Position Batteries of the Royal Jersey Artillery Militia in 1890 and 1891, it proved to be practically incorrect.

Works published recently by the Intelligence Division of the War Office:—

Maps of the Anglo-French Boundary in Senegambia, by Captain A. H. Kenney, R.E., 4 sheets, scale 2 miles = 1 inch.

"Modern Military Rifles and Carbines."

The following Maxims are extracted from a MS. Note-book of "Remarks on the Repository Exercises," dated Woolwich, 1st October, 1811, the property of Lieutenant J. F. Scott, 2nd Battalion R.A., kindly lent to the Committee by his nephew Colonel C. E. S. Scott, R.A.

I.

No piece of ordnance should be brought into the Field that is not capable of destroying a file of men of at least four deep at the distance of 400 yards.

II. & III.

Of no special interest.

IV.

At a distance of 800 yards the Range of a cannon can be but little depended on, at 400 yards it begins to be more certain, but it is at 200 yards only that they are truly destructive. Therefore whilst the ennemy is still at the first-named distance your Fire should be *Slow*, merely with a view to interrupt their manœuvres, and as it also allows time to level your guns well; at the second distance (400 yards) *Brisk*, to check his march; at the third *Quick*, to break his line.

V.

Round shot generally do an ennemy more injury than case shot.

VI.

Grape and Cannister shot do not do an ennemy so much injury when near as common lead Balls enclosed in a Bag of thin cloth.

VII.

The usual distance to fire Grape is 200 yards, and that of Case 120 yards.

VIII.

A Cannonade which had no further object in view, than to kill a few Passing soldiers without reference to or Derangeing the Ennemy's Plans would neither do honour to He who commanded, or He who should execute it.

IX.

Of no particular interest.

X.

The utmost care must be taken not to place your Brigades of Artillery immediately in front of your own troops nor on ground of *Little Elevation* directly behind them.

XI. & XII.

Relate to positions.

XIII.

Never fire your Artillery in *Volleys*, but one gun after the other that your fire may be *constant* and Incessant.

XIV.

It is dangerous to let your Brigades be seen till the moment they are to act.

XV. to XVIII.

Not so interesting.

XIX.

Suffer no part of your Artillery to remain useless.

XX.

Concerns replacing ammunition.

XXI.

The Officer Commanding a Brigade in time of action ought to direct his fire in preference on the Enemy's Troops, without paying much attention to their Cannon if the latter be not playing on him.

The last six maxims treat of the Infantry escort for guns, and duties of a General of Artillery.

The following are Noted as Worthy of the Attention of all Military Readers.

1. "Studies in Tactical Progress during the last Twenty-Five Years." Blackwoods: Edinburgh Magazine. July and August, 1891.
2. "1806 *v.* 1870." Another view by Captain W. James. U.S. Magazine. September, 1891.
3. "Military Criticism and Modern Tactics, I. and II." By the author of "The Campaign of Fredericksburg." U.S. Magazine. August and September, 1891.
4. "Magazine Rifles in War." By Surgeon-Captain Marsh. Journal of the U.S. Institution. November, 1891.
5. "Colonel V. Löbell's Annual Reports upon the Changes and Progress in Military Matters during 1890." Journal U.S.I. November, 1891.
6. "The Proper Employment of Cavalry in War." By Captain A. E. Wood. Journal of the U.S. Cavalry Association. June, 1891.
7. "The Effect of Small Calibre Arms and Smokeless Powder upon Cavalry Operations of the Future." By Captain A. E. Wood. Journal of the U.S. Cavalry Association. June, 1891.
8. "Mounted Infantry." St. Penn. Journal of the U.S. Institution, N.Z. November, 1891.
9. "Two Brigades." Captain Hoeing. Translated by St. Penn. Journal of the U.S. Institution, N.Z. November, 1891.
10. "The Progress of Tactics from 1859 to 1890, and the Attack of the Future." Major-General Von Boguslawski. Translation. U.S. Magazine. November, 1891.

a. "Military Literature and the British Army." By Spencer Wilkinson. U.S. Magazine. September, 1891.

b. "The Education of Military Officers." By Walter Wren. The Fortnightly Review. August, 1891.

c. "General Craufurd and his Light Division." Griffith, Farran & Co.

WOOLWICH.

At the beginning of the hunting season the Members of the R.A. Drag Hunt presented to Mr. George Maxwell a very handsome silver bowl, on the occasion of his leaving the Manor Farm, Kidbrook, Blackheath, where for twenty-five years he has been a true friend to the Hunt.

OBITUARY.

By the death of Major W. J. Robertson, which occurred at Gibraltar, on 15th November, 1891, the Regiment has lost one of its best officers, and the Institution a frequent and interesting contributor to its "Proceedings." His capacity for work was remarkable, and his indomitable energy enabled him to study and master many and various subjects. As a Horse Artilleryman, he collected interesting records of that branch for these "Proceedings," lectured on the subject at the United Service Institution, and was a champion of the Horse Artillery, but when promotion took him to Gibraltar with equal enthusiasm he took up the fresh line, and was furnishing us with valuable papers on the Navies of Europe, only three of which he lived to complete. All who have been lately at Woolwich will bear witness to his excellent work in the Mess, he spared no time or trouble to secure its efficiency, while his organising powers and mastery of detail enabled him to carry out much-needed economics. In one word, and few men have more claim to the description, he was "Thorough."

Lieutenant F. Bayly, who died at Bath, on the 16th November, 1891, was appointed 2nd Lieutenant on the 5th June, 1809. He served in the Peninsular War from 1810 to 1814, including the battle of Busaco, on 2nd September, 1810. He was also at the engagement of Castalla, receiving the silver medal and Busaco clasp. In 1814 he embarked for America, and was present at the attacks on Baltimore and New Orleans, where he was slightly wounded. He returned to Europe in 1815, and accompanied the Prussian armies to France after Waterloo. He was placed on half-pay on 20th June, 1829, and on retired pay 1st July, 1881. When the late Major Robertson was collecting information about the R.A. Mess it is believed that Lieutenant Bayly was able to tell him from his own memories many quaint stories of dinners and entertainments at the Mess in the early part of the Century.

Major-General F. Dick died at Lympstone, West Exeter, on the 5th November, 1891. He entered the Royal Artillery, 18th December, 1829, became Lieutenant 26th November, 1830; 2nd Captain, 23rd November, 1841; Captain, 29th July, 1846; Lieut.-Colonel, 20th June, 1854; Colonel, 20th June, 1857; Major-General, 12th February, 1864, when he retired on full pay.

Major-General Donald McNeill (late Bengal Artillery), died at Edinburgh, 18th November, 1891. He joined the Bengal Artillery 10th June, 1842, and retired on full pay 1st August, 1872. He served in the Gwalior Campaign of 1843-44, and battle of Maharajpore (bronze star); Sutlej Campaign of 1845–46, including the battles of Ferozeshah and Sobraon (medal and clasp); served with the Turkish contingent from 24th March, 1855, to 4th July, 1856 (4th class of the Medjidie and Turkish medal); served with the Ghoorka force at the fall and capture of Lucknow in 1858 (mentioned in despatches, brevet of Major, medal with clasp).

Colonel W. F. B. Laurie, Royal Artillery (late Madras), who died at Chiswick, on the 10th November, 1891, joined the Madras Artillery in January, 1842, and retired on full pay 26th January, 1870. Served with the Nigool Field Force from 15th January to 7th February, 1848, and was present at the taking of the stockade of Hurrithputterghur. Served in the second Burmese War from 31st March, 1852, including the attack and capture of Rangoon, affairs of Kyonkyedurg and Gongho, and with a field force to Myonkhala (medal). He wrote, among other works, the "First and Second Burmese Wars" and "Distinguished Anglo-Indians," both of which were successful.

DIARY OF FIXTURES.

DECEMBER.

Days of the Mth.	Week	
1	T	
2	W	R.A. Band Concert at Woolwich at 9 p.m.
3	Th	
4	F	R.A. Band Concert at St. James's Hall at 3 p.m.
5	S	
6	**S**	
7	M	
8	T	
9	W	R.A. Band Concert at Woolwich at 3 p.m.
10	Th	
11	F	
12	S	
13	**S**	
14	M	
15	T	
16	W	R.A. Band Concert at Woolwich at 3 p.m.
17	Th	
18	F	
19	S	
20	**S**	
21	M	
22	T	
23	W	
24	Th	
25	F	Christmas Day.
26	S	Boxing Day.
27	**S**	
28	M	
29	T	
30	W	
31	Th	

JANUARY.

1	F	
2	S	
3	**S**	
4	M	
5	T	
6	W	
7	Th	
8	F	
9	S	
10	**S**	
11	M	

Days of the Mth.	Week	JANUARY.—*Continued.*
12	T	
13	W	
14	Th	
15	F	
16	S	
17	**S**	
18	M	Lecture at 9 p.m. at R.A. Institution, by Lieut.-Col. N. L. Walford, R.A., on "Swiss Artillery Practice."
19	T	
20	W	
21	Th	
22	F	
23	S	
24	**S**	
25	M	
26	T	
27	W	
28	Th	
29	F	
30	S	
31	**S**	
		FEBRUARY.
1	M	
2	T	
3	W	
4	Th	
5	F	
6	S	
7	**S**	
8	M	
9	T	
10	W	
11	Th	
12	F	
13	S	
14	**S**	
15	M	
16	T	
17	W	R.A. Band Concert at Woolwich at 3 p.m.
18	Th	
19	F	
20	S	
21	**S**	
22	M	
23	T	
24	W	R.A. Band Concert at Woolwich at 3 p.m.
25	Th	
26	F	
27	S	
28	**S**	
29	M	

PRÉCIS
AND
TRANSLATIONS.

"REVISTA DI ARTIGLIERA E GENIO."

AN APPARATUS FOR CHECKING RECOIL.

TRANSLATED BY

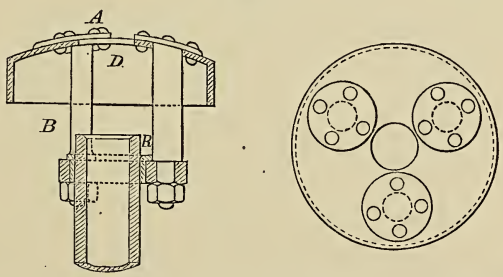
CAPTAIN R. M. B. F. KELLY, R.A.

THE *Mittheilung über gegenstände des Artillerie-und Genie-Wesens* contains a notice of two different apparatus for checking the recoil of guns, of recent invention, one of which is due to the French Captain De Place, and the other to Signor Nottbeck, of Finland. They are both based on the same principle, viz., the utilisation of the expansion of the gases issuing from the muzzle on discharge.

In accordance with an Admiralty order, Captain De Place's apparatus has recently been tried with a field gun of 80^{mm} (3·1″), and noteworthy results were obtained.

The apparatus consists of a cap *A* (Fig. 1[a]) of plates of steel 8^{mm} (·31″) thick, the concave side being towards the muzzle, it is continued towards the rear by a cylinder having a diameter of 40^{cm} (15·75″). This cap is rigidly attached by 3 solid bolts *B* to a ring shrunk on to the chase of the piece. A central aperture *D* allows of the passage of the projectile, with a small amount of play (5^{mm} = ·197″ for a projectile 80^{mm} diameter).

FIG. 1[a]



During the time that it takes for the projectile to traverse the length of the bore, the recoil is developed in accordance with the same laws that would control it if the apparatus were not there. The projectile then having left the bore, moves forward through the aperture in the cap, it is followed by the powder gas, which after leaving the bore tends to expand in all directions: the central portion has free passage through the aperture, the remainder is held by the cap and projected backwards with great violence, the consequence being that the cap and hence the gun is subject to a force acting in the opposite direction to the force of recoil.

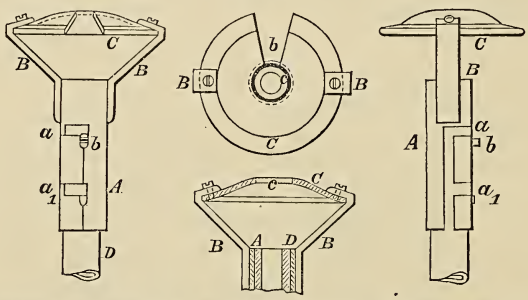
The diagram of the velocity of recoil as demonstrated by Seberts' velocimetre, shows that the force which urges the gun back during recoil, is subject to a series of oscillations, which, however, succeed each other so rapidly, that the force may be considered as continuous—the changes in the velocity of recoil, *i.e.* its alternate increase and decrease are due to the elastic reaction of the bore.

It has been ascertained by this velocimetre that the velocity of recoil of a gun not provided with the apparatus we are discussing, increases up to a certain maximum which is reached soon after the projectile has left the bore. This maximum (in the gun experimented with *i.e.* 80 mm) was about 4·1 m.s. (13·45 f.s.) and was reached in ·04″ after the projectile had left the bore. When the same gun was fitted with the gas bridle (as we may appropriately term the apparatus) the velocimetre showed that the velocity of recoil at first increased, reached its maximum *as* the projectile left the bore, and then began to decrease. According to experiments made, the maximum velocity of recoil was 3·45 m.s. (11·32 f.s.) and was reached in less than ·01″ after the projectile had left the bore; further, that ·03″ or ·04″ after it had left the bore the velocity of recoil did not exceed 2 m.s. (6·56 f.s.). It was also ascertained that the initial velocity of the projectile increased from 476 m.s. (1561 f.s.) to 481 m.s. (1578 f.s.) which increase may be attributed to the action of the gas on the base of the projectile during its passage through the aperture in the cap. It may be dednced from this that the accuracy of the piece must infallibly have been increased.

The gas thrown back by the Bridle causes some annoyance to the detachment: this inconvenience might be overcome by continuing the sides of the cap still further back and joining their inner ledge to the chase, or a fan (or screen) might be attached to the breech portion of the gun, which would serve as a shield. Such an arrangement applied to Quick Firing guns would render possible the use of larger calibres than those which have now been adopted for repelling torpedo attacks.

The recoil of a 80 mm field gun provided with the ordinary recoil break, but without the De Place "gas bridle" had, according to experiments made, a velocity of 1·54 m.s. (5·05 f.s.), with the De Place "bridle," only ·4 m.s. (1·31 f.s.).

Fig. 2ª.



The similar apparatus invented by Signor Nottbeck (Fig. 2ª) consists of a thin plate of metal *C* solidly united, in the way we shall describe, to the gun *D*, the plate has a central hole *C*, which gives passage to the projectile, and is furnished with a notch *b* which allows of the gun being laid by means of the foresight *b*. By means of the strong clamps *B*,*B*, the plate is attached to a collar (lit muff) *A* provided with a slot parallel to the axis of the piece, from which two other slots a_1 a_1 open at right angles—the foresight fits into one or other of these slots and thus fixes the apparatus.

The mode of action is the same as in De Place's apparatus. The size of the plate *C* and its distance from the muzzle of the piece, as well as its strength, must be determined by experiment for each nature of gun or small-arm.

"RUSSIAN ARTILLERY JOURNAL."

JANUARY, 1891.

"ON THE ANGULAR VELOCITY OF ROTATION OF AN ELONGATED PROJECTILE."

BY

CAPT. N. ZABÚDSKI, Russian Artillery of the Guard.

Précis TRANSLATION BY

MAJOR G. T. KELAART, R.A.

I.

For the purpose of increasing the effect of fire in siege warfare, fougasse shells with very large bursting charges are now being introduced.

For a given weight, the shells are designed to contain the maximum quantity of explosive, their length coming up to 6 calibres. Experiment shows that, in service guns with the present twist, increase of length of projectile, beyond a certain limit, diminishes the accuracy. We will here endeavour to investigate the proper twist for a given projectile.

The method of treatment of problem is as follows :—the tangent at any point to the trajectory, described by the *C.* of *G.* of projectile, is supposed to be fixed, and the axis of figure is supposed to have a conical motion round it, during which the angle δ between the axis of figure and the fixed tangent changes periodically.*

To avoid these oscillations (nutations) which, when of appreciable magnitude, influence, prejudicially, the accuracy of shooting,† and in order that the axis may describe a circular cone (precession) round the fixed tangent, the following conditions must be fulfilled, from which is deduced the formulæ (11), fixing the twist for a given shell and for given magnitude of couple of air resistance.

Experiments showed that, to obtain accuracy, the twist at muzzle must not be less than a certain limit, which is approximately that obtained from the formulæ (11) or (17), after making certain suppositions regarding the couple of air resistance.

* The Author, regarding this conical motion, refers to N. Majevski's "Traité de Balistique," p. 163.

† And also adds "With individual rounds the time of reaching a defined point of trajectory must inevitably vary. Since the period of oscillation $\left(t_0 = \frac{2\pi B}{A p_0}\right.$ Majevski's "Traité de Balistique," p. 163) is not great, the magnitude of δ will always vary at each round."

It is noticed below that a decrease of pitch at the limits met with in practice does not influence sensibly the accuracy.

However, from the reasons explained further on and confirmed by the shooting from a 3·4″ mortar, with twists at muzzle of 15 and 5 calibres, it is seen an excessive rapid twist might, with vertical fire and small initial velocity, lessen somewhat the accuracy.

By far the most interesting work of the problem now touched upon, belongs to Greenhill, Professor at the Woolwich Artillery College. Greenhill* assumes the projectile is an ellipsoid, and moves equably and rectilineally, in an incompressible fluid, the velocity of the parts of which has a potential, subordinate to certain conditions.

Our investigations show two methods for deducing the equation (7) which solves the problem. One method is based on the geometrical theories of the motion of a solid body and the other on Euler's formulæ.

II.

We will suppose that the uniform acting air resistance is in the plane of the tangent and axis of figure, and that the centre of air resistance lies in front of the $C.$ of $G.$ The rotation of projectile is from right to left, looking from the point towards the $C.$ of $G.$

In the expression for its moment, the air resistance is taken to act only normally to the surface, the air friction being neglected, as also, variations of pressure on the surface.

With these suppositions we may assume that the couple of the air resistance

$$K = h.\ R.\ \rho \sin \delta \cos \delta \dagger \quad \ldots \ldots \ldots \ldots \ldots \quad (1).$$

Here R is radius of projectile,

ρ is air resistance,

h is a numerical co-efficient.

For small angles δ‡

$$K = h.\ R.\ \rho.\ \delta. \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (2).$$

III.

Let Ox, Oy, Oz, (Fig. 1.) be the central axes of moments of inertia, Ox coinciding with axis of figure, Oy with direction of the principal linear moment of air resistance K§ (axis of couple of air resistance), which is perpendicular to Ox and a tangent to trajectory. The projectile, with its principal axes, is referred to axes Ox_1, Oy_1, Oz_1 fixed in space, where Ox_1 is the direction of the tangent supposed to be fixed, Oz_1 is in the vertical plane, Oy_1 is evidently perpendicular to plane passing through Ox_1, Ox, Oz.

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* Professor A. G. Greenhill "On the rotation required for the stability of an elongated projectile," Proceedings, Royal Artillery Institution, 1879, in whose treatment the couple is due to the slight disturbance of the adjacent stream lines of the air, due to the sidelong oscillations of the projectile. (Translator).

† Majevski's "Traité de Balistique Exterieure," p. 170.

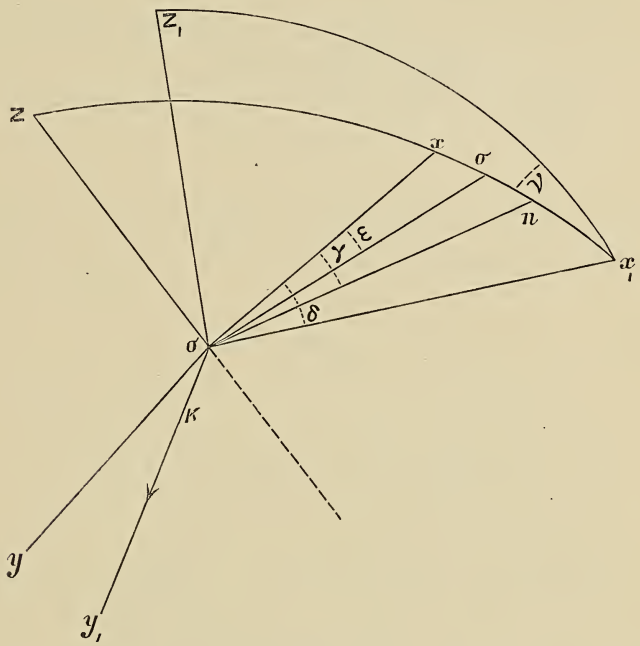
‡ Majevski "On solution of problems of direct and vertical fire," p. 66.

§ The positive direction of axis of rotation is here contrary to that usually assumed.

ν denotes the linear angle formed by the plane, passing through Ox and Ox_1, and the vertical plane, δ the angle between Ox and Ox_1.

Let the projectile turning round the fixed point O be transposed so that δ remains constant,* ω being the angular velocity round instantaneous axis OJ, and p, q, r, its projections on Ox, Oy, Oz. From the conditions regarding δ, we get $q=0$, *i.e.*, OJ lies in plane xOx_1. Therefore $p=\omega \cos \epsilon$, and $r=-\omega \sin \epsilon$, where ϵ is angle between OJ and Ox.

Fig. 1.



Let G denote the principal linear moment of all the quantities of motion ; its projections on Ox, Oy, Oz are Ap, 0, Br respectively, A being the moment of inertia of projectile relative to Ox, and B relative to equatorial axis passing through C. of G., hence G lies in plane zOx or xOx_1 and

$$\left.\begin{aligned} G \cos \gamma &= A\omega \cos \epsilon = Ap \\ G \sin \gamma &= B\omega \sin \epsilon = Cn \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

where γ is the angle between G and Ox.

The angular velocity round Ox_1 will be $\frac{dv}{dt}$.

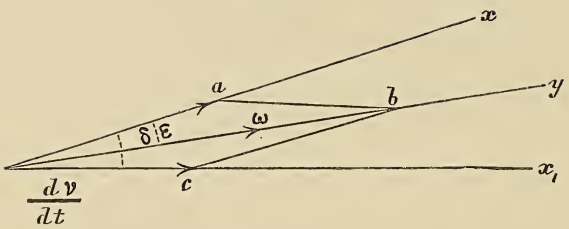
---

* We will notice that δ varies as the tangent passes from one position to the other.

From the triangle Obc (Fig. 2) we get

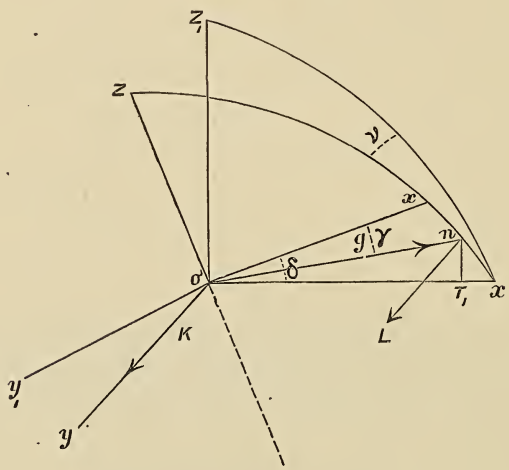
$$\frac{dv}{dt} = \omega \frac{\sin \epsilon}{\sin \delta} \quad \ldots \ldots \ldots \ldots \ldots \ldots \quad (4)$$

Fig. 2.



We proceed to find the relation between $\frac{dv}{dt}$ and the principal linear moment K of the impressed forces.

Fig. 3.



From Analytical Mechanics,* the principal moment $On = G$ (Fig. 3) of all the quantities of motion of a solid body taken relatively to O; and if drawn from O, moves about O, so that the velocity of its end is constantly equal and parallel to the length K.

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*Professor Bobilef "Course of Analytical Mechanics," pp. 454-456.
Resal "Traité de Mecanique général, 1873," p. 247, Vol. 1.

From this we infer the velocity nL of the end of On equals K, *i.e.*,

$$nL = K ;$$

and since the principal moment of the air resistance is perpendicular to xOx_1, then nL is perpendicular to same plane.

Hence the angular velocity of xOx_1 round Ox_1 is fixed by the equation

$$\frac{dv}{dt} = \frac{nL}{nT_1} = \frac{K}{nT_1}$$

From the triangle nOT_1,

$$nT_1 = G \sin (\delta - \gamma)$$

$$\therefore \quad \frac{dv}{dt} = \frac{K}{G \sin (\delta - \gamma)} \quad \ldots \ldots \ldots \ldots \ldots \quad (5)$$

and

$$G \sin (\delta - \gamma) \frac{dv}{dt} = K \quad \ldots \ldots \ldots \ldots \ldots \quad (6)$$

From (3) and (4),

$$G \sin \gamma = B \frac{dv}{dt} \sin \delta \quad \ldots \ldots \ldots \ldots \ldots \quad (6_1)$$

From (3), (6), and (6_1),

$$Ap \sin \delta \frac{dv}{dt} - B \sin \delta \cos \delta \left(\frac{dv}{dt}\right)^2 = K \quad \ldots \ldots \quad (7)$$

Hence

$$\left(\frac{dv}{dt}\right)^2 = \frac{Ap}{2B \cos \delta} \pm \sqrt{\frac{A^2 p^2}{4 B^2 \cos^2 \delta} - \frac{K}{B \sin \delta \cos \delta}} \quad \ldots \quad (8)$$

Now in a vacuum $K = 0$, and therefore $\frac{dv}{dt} = 0$, which shows the negative sign before the root need only be retained.

In order that $\frac{dv}{dt}$ should be real,

$$A^2 p^2 \geq 4 \frac{BK}{\tan \delta} \quad \ldots \ldots \ldots \ldots \ldots \ldots \quad (9)$$

Therefore the minimum velocity is determined from the following equation

$$A^2 p^2 = 4 \frac{BK}{\tan \delta} \quad \ldots \ldots \ldots \ldots \ldots \ldots \quad (10)$$

or

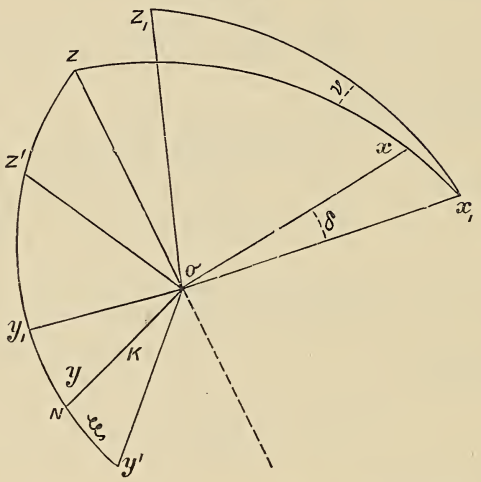
$$p = \frac{2}{A} \sqrt{\frac{BK}{\tan \delta}} \quad \ldots \ldots \ldots \ldots \ldots \ldots \quad (11)$$

IV.

We will now show the method of getting equation (7) from Euler's equations.

Refer the projectile and principal axes Ox, Oy', Oz' (Ox is axis of figure, Fig. 4) to rectangular co-ordinates Ox_1, Oy_1, Oz_1, of which Ox_1 coincides with the tangent, and Oz is in the vertical plane passing through the trajectory.

Fig. 4.



The intersection ON of the planes $y'Oz'$ and y_1Oz_1, being perpendicular to Ox and Ox_1, represents the direction of K.

Calling the angle NOy', ξ, the projections of K on Ox, Oy', Oz' are: zero, $K \cos \xi$, and $K \sin \xi$.

Therefore the equations for the rotating projectile are*

$$\left.\begin{aligned} A\frac{dp}{dt} &= 0 \\ B\frac{dq'}{dt} + (B-A)\,pr' &= K\cos\xi \\ B\frac{dr'}{dt} - (B-A)\,pq' &= K\sin\xi \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad (12)$$

We will refer the motion to axis of figure x and two rectangular axes y and z perpendicular to x, which do not share in the rotation round axis. The axis y coincides with ON; y and z will be at each moment the principal axes of inertia, q' and r' are the component angular velocities about Oy' and Oz'.

The rotation of a body round any axis is equivalent to three successive rotations round three axes not parallel to one plane. We may take for these axes either the principal axes x, y, z, or $ON = Oy$, Ox and Ox_1.

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* N. Majevski's "On the solution of problems of direct and vertical fire."

The angular velocities round the former are p, q, r; and round the latter

$$\frac{d\delta}{dt}, \quad \frac{d\xi}{dt}, \quad \frac{d\nu}{dt}.$$

Resolving the latter along x, y, z, then

$$\left.\begin{aligned} p &= \frac{\delta\xi}{dt} + \cos\delta\,\frac{d\nu}{dt} \\ q &= \frac{d\delta}{dt} \\ r &= -\sin\delta\,\frac{d\nu}{dt} \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (13)$$

If we suppose the projectile turning round O so transpose itself that δ remain constant, $\frac{d\delta}{dt}$ and $q=0$, and, taking this into consideration, we obtain

$$q' = -r\sin\xi, \quad r' = r\cos\xi.$$

By differentiating these last two expressions, and combining with the last two in (12) we get two equations, which lead to following equation

$$-Br\,\frac{d\xi}{dt} + (B-A)\,rp = K$$

which combined with the first and third of (13) lead to the equation

$$Ap\sin\delta\,\frac{d\nu}{dt} - B\sin\delta\cos\delta\left(\frac{d\nu}{dt}\right)^2 = K$$

identical with (7).

The first equation of (12) shows p is constant the whole time, *i.e.*, $p = p_0$.

V.

If η denote the pitch of rifling expressed in calibres from (11) we get

$$p_0 = \frac{\pi V}{\eta R} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (14)$$

From (11) we see p will be greater, the greater $\frac{K}{\tan\delta}$, we ought then, in (11) to substitute the greatest magnitude of $\frac{K}{\tan\delta}$ in order to determine η. Assuming for K the expression (1) we find

$$\frac{K}{\tan\delta} = h\,R\,\rho\cos^2\delta$$

The maximum rotation will be at departure, when $v = V$ and $\delta = 0$. Bearing this in mind, we get from (11) and (14)

$$\frac{\pi V}{\eta R} = \frac{2}{A}\sqrt{Bh\,R\rho}$$

whence

$$\eta = \tfrac{1}{2}\sqrt{\frac{A^2}{B}\,\frac{\pi^2 V^2}{h R^3 \rho}} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (15)$$

$$\text{On putting} \quad A=\mu\frac{P}{g}R^2,\ P=kR^3 \qquad \rho'=\frac{\rho}{\pi R^2 V^2} \qquad \left.\begin{array}{l}\\ \\ \end{array}\right\} \ \ldots\ \ldots\ \ldots\ \ldots \quad (16)$$

μ and k being numerical coefficients ; hence

$$\eta=\tfrac{1}{2}\sqrt{\frac{A}{B}\,\frac{\pi\mu k}{gh\rho'}} \quad \ldots\ \ldots\ \ldots\ \ldots\ \ldots \quad (17)$$

From the last formulæ we conclude

(1) For similar projectiles the pitch at muzzle does not vary with the calibre.

(2) With the increase of relative length of projectile the pitch η decreases, since $\frac{A}{B}$ and h increase with the length.

(3) With the same calibre, η decreases with the decrease of weight of projectile and with the increase of air resistance, because here k decreases and ρ' increases.

Having determined from (17) the pitch η corresponding to a projectile of determined and length l, we get approximately the pitch η_1 for projectile of same weight and calibre, but of length l_1 from the equation

$$\frac{\eta_1}{\eta}=\left(\frac{l}{l_1}\right)^{\frac{3}{2}} \quad \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots \quad (18)$$

This follows from (17), assuming that the moment of inertia B relatively to the equatorial axis is proportional to the square of length of projectile and the coefficient h to the length of projectile, but that μ does not change with the length.

Calculations show that these suppositions approximately hold for projectiles of the present service form.

VI.

We will calculate from (17) the pitch at muzzle necessary for the steady flight of the

(1) 11″ cast iron shell of length 2·8 cals. ;

(2) 8″ steel fougasse shell of length 4·5 cals. ;

(3) 6″ steel fougasse shell, with cast iron head, of $3\frac{1}{3}$ cals.

Practice was carried on with these projectiles from guns of different twists at muzzle. The results show to what extent the formula is applicable to the solution of the problem.

(1) The gun used was the 11″, of 1877 pattern ; here weight

$$P = 217{\cdot}7 \text{ kilos (530 Russian pounds)},$$

$$R = 0{\cdot}140 \text{ m.},$$

$$\log k = 4{\cdot}9010,$$

$$\text{ratio } \frac{B}{A} = 4{\cdot}3,$$

$$\mu = 0{\cdot}53.$$

In direct fire the initial velocity ordinarily exceeds 419 m.s. (1374·7 f.s.) hence $\rho' = {\cdot}0394$.

We have no immediate experiments for the determination of h, therefore we must have resource to the theoretical formula* deduced on the supposition that the air resistance is proportional to square of the velocity, and the angle δ is so small that it is possible to neglect its terms of the second order ; here $h = 7{\cdot}74$.

Hence (17) gives us $\eta = 50{\cdot}4$, as the maximum pitch for a projectile of 2·8 cals. just sufficient for steady flight.

In the 11″ gun, 1877 pattern, the pitch is 45 cals.

Experiments showed that with this twist the accuracy is wholly satisfactory, whilst, with a pitch of 70 cals. with same projectiles of 2·8 cals., the shooting was bad.

Keeping to the same weight, (18) gives the pitches corresponding to projectiles of different lengths.

Assuming $\eta = 50$ and $l = 2{\cdot}8$, we get the following table :—

l in cals.	η pitch in cals.
2·0	83·5
2·5	59·8
3·0	50·4
3·25	40·3
3·5	36·1
4·0	29·5
4·5	24·7
5·0	21·1
6·0	16·1
10·0	7·5

(2) For the 8″ fougasse steel shell—4·5 cals.

$$P = 88{\cdot}91 \text{ kilos (217 Russian pounds)},$$

$$R = 0{\cdot}1016 \text{ m.},$$

$$\log k = 4{\cdot}9063,$$

$$\frac{B}{A} = 13{\cdot}0,$$

$$\mu = 0{\cdot}613.$$

* N. Majevski's "The solution of problems of direct and curved fire," p.p. 60-67.

Assuming the air resistance proportional to square of velocity,

$$h = 12{\cdot}74.$$

$$\rho' = 0{\cdot}0394.$$

With these data, formula (17) gives

$$\eta = 25{\cdot}1$$

(this is near $\eta = 24{\cdot}7$ of the above table, l being 4·5).

In shooting from an 8″ mortar with a pitch of 35 cals. the accuracy of 4·5 cals. projectiles was unsatisfactory, although satisfactory when fired from the 8″ and 9″ light mortars with a pitch of 15 cals.

The projectiles fired from the 8″ light experimental gun with a pitch of 25 cals. were ordinarily steady in flight, however, solitary unsteady ones were observed. We must conclude that a pitch of 25 cals. is the extreme limit for a projectile of 4·5 cals. This follows from (17).

To guarantee a satisfactory accuracy from the 8″ light guns, the pitch should be 20 cals.

(3) For the 6″ fougasse steel shell, with cast iron head, of $3\frac{1}{3}$ cals. designed by General Engelbard,

$$P = 33{\cdot}28 \text{ kilos (81·25 Russian pounds)},$$

$$R = 0{\cdot}0762 \text{ m.},$$

$$\log k = 4{\cdot}8761,$$

$$\frac{B}{A} = 6{\cdot}874,$$

$$\mu = 0{\cdot}606.$$

Assuming the air resistance proportional to square of velocity, we shall find

$$h = 8{\cdot}96,$$

$$\rho' = 0{\cdot}0394;$$

with these data $\eta = 38{\cdot}5$.*

When fired from a 6″ gun 190-pr., (Russian) of the 1877 model, with a pitch of 45 cals., projectiles of $3\frac{1}{3}$ cals., designed by General Engelbard, were very unsteady, but from the 6″ gun 120-pr. (Russian), with a pitch of 25 cals., the accuracy was satisfactory.

VII.

Hence, for steady flight of a projectile of the given design, the pitch must not exceed a certain limit, which, evidently, is got from (17).

The shearing strength of driving bands ordinarily limits the least pitch.

There are sufficient experiments showing that decrease of pitch at the limits met with in practice does not influence sensibly the accuracy. For example, from the 9″ mortar, with pitches of 40, 35, and 20 cals.,

* Assuming for initial date $\eta = 50{\cdot}4$ and $l = 2{\cdot}8$, from (18) we find $\eta = 38{\cdot}8$ for shell of $3\frac{1}{3}$ calibres.

at angles of elevation 43½° and 60°, the dispersion of 2·5 cals. projectiles was very little different, when the weather was favourable.

However, an excessive rapid twist might diminish the accuracy in vertical fire, and with low velocities from the following causes :—

With the increase of angular velocity increases also the angle δ (the other data being the same) between the axis of figure and the tangent which increases the air resistance, and this may influence, prejudicially, the accuracy. For example, from two 3·4″ mortars, with twists 15 cals. and 5 cals. and 2·6 cal. projectiles, the accuracy was the worst from the latter.*

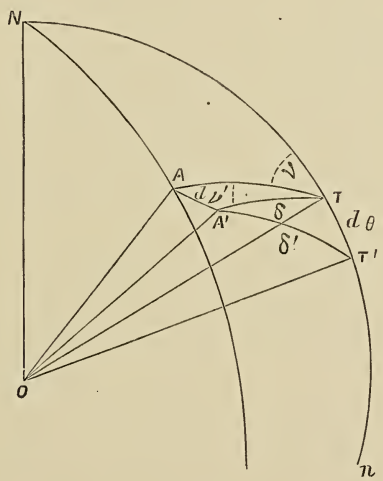
In order to show upon what data the changes of δ† depend, we will imagine a sphere described with a radius equal to unity, the centre being O (Fig. 5).

Let OT represent up to the time t from the commencement of motion the direction of the tangent to the trajectory ; draw through OT the vertical plane of fire which, on the surface of the sphere, is represented by the arc NTn.

Let the straight line OA represent, up to the time t, the direction of the axis of figure.

The angle ν between the vertical plane NTn, and the plane passing through OT and OA will be measured by the angle NTA, and δ by the arc AT.

At the following moment let the axis of figure transfer itself to OA', and the tangent will take up the position OT in the vertical plane of fire.



When the projectile has the proper amount of rotation imparted to it, we may assume that the angle $AT=\delta$ will not change during the rotation of the plane AOT round the fixed axis OT, from this $A'T=\delta$

* Impressions of grooves on driving bands were correct.

† The author adds, "here we have in view only the case, when δ increases slowly in the whole extent of trajectory." (N. Majevski "Traité de Balistique," p.p. 201-206).

and the angle $A'TA$, represented by $d\nu'$, is obtained from (8) so that

$$d\nu' = \frac{A\mu}{2B\cos\delta}\left\{1-\left[1-1\frac{4KB}{A^2p^2\tan\delta}\right]^{\frac{1}{2}}\right\}dt.$$

Since p is large, we need only retain the first terms in the expansion of the second term within the brackets, so that

$$d\nu' = \frac{K}{Ap\sin\delta}\,dt \qquad (19)$$

Let θ denote the angle OT makes with the horizontal plane and $\delta' = A'T'$.

From the triangle $A'TT'$, $\delta' = \delta + d\delta$; hence $d\delta$ is greater, the greater $A'\,TT' = 180 - \nu - d\nu'$, or the less $d\nu'$.

From (19) we see $d\nu'$ diminishes with the increase of the angular velocity $p = \frac{\pi V}{R\eta}$, or with the decrease of the pitch; and, therefore, the angle δ will increase.

This last conclusion serves to confirm the remarks above regarding the influence of an excessive twist on the accuracy, when firing at high angles of elevation and with low velocities.

September 9th, 1891.

"REVUE D'ARTILLERIE."

THE GRAYDON DYNAMITE PROJECTOR.

[*EDITORIAL.*]

TRANSLATED BY

LIEUT.-COLONEL F. E. B. LORAINE, *late* R.A.

MR. GRAYDON, formerly Lieutenant in the United States Navy, has sought in the above invention to introduce a more handy weapon than the pneumatic guns of Mefford and Zalinski. The Zalinski 8-inch gun, which is capable of throwing 100 lbs. of dynamite a distance of 4000 yards, is 90 calibres in length, or in other words, no less than 60 feet. Whereas Graydon's 15-inch gun, which projects 600 lbs. of dynamite and has a range of 5200 yards, is only 24 calibres in length, or 30 feet.

The problem for solution consisted in saving the charge of dynamite from the heat generated by the friction of the projectile in the bore and from the violence of the shock of discharge. To meet it Mr. Graydon has adopted the following arrangements.

The projectile is of steel, with thick walls and a solid head. The interior is coated with a thick layer of amianthus (flexible asbestos), which serves as a lining and as an isolator of its contents from heat. The dynamite is divided either into small spheres, or $\frac{1}{2}$-inch cubes, or small cartridges, and each of these portions of the charge is wrapped in paper, which is saturated with paraffin to make it gas-tight. This arrangement hinders the accumulation of nitro-glycerine in case of exudation, and prevents the full force of the discharge taking effect on the whole of the mass. In projectiles of large calibre Mr. Graydon separates the cartridges by means of tin plates or wood shaving. Finally, a wad placed at the base of the projectile contributes also to the deadening of the shock of discharge.

The dynamite is fired by means of a central tube containing a detonating charge, which is fixed to the front of the chamber of the projectile. In the first trials this tube carried in front a spiral spring, of which one end carrying a friction bar was fixed, while the rear end carried a priming and was free to be thrown against the friction bar on impact. This primitive arrangement has been since considerably improved.

To see how the dynamite would behave in this shell the first experiments were made with ordinary guns. First, at San Francisco, a 2·9-inch field piece was used, then 52 rounds were fired from a 4·5-inch siege gun, and finally, in the summer of 1887, at Sandy Hook, the permanent Ordnance Commission carried out a series of more important trials which shall here be enumerated.

Guns of various calibres were employed, among them a wrought-iron Amies 7-inch M.L. gun, charge 23 lbs., projectile 122 lbs. The latter was a regulation shell, in the base of which a large hole was pierced to introduce the dynamite, in this case amounting to 2 lbs. 12 ozs.

The target was a turret 12 inches thick (two 6-inch plates), with a 3-inch roof plate, and a port in the centre, the whole being secured by $1\frac{3}{4}$-inch bolts.

The first projectile was not primed; it struck the turret in line with the top

of the port and 30 inches to its left. It penetrated about 2¼ inches and exploded with great violence. The roof, weighing about 14 tons, was torn off and thrown to the rear, seven bolts were broken, and there were several cracks.

The second projectile was primed. It struck the turret immediately below the first, enlarging all the gaps made by it.

The third projectile, also primed, struck the turret about 35 inches to the left of the lower edge of the port. It penetrated the front plate, entering by an existing fissure about three inches deep, and made an indent on the rear plate, besides which the two plates were *cracked and completely disjointed in every direction*. One fragment, weighing about 24 cwt., was thrown to a distance of six yards.

On the 2nd December following, four rounds were fired, the first against a wooden wall at a range of a mile, resulting in a premature burst about 400 yards from the object. The second, fired under the same conditions, bursting against the wall or immediately after passing through it. The third, fired seaward at an elevation of 8° 30′, did not burst on touching the water. The fourth and last, fired to sea at an angle of 13° 30′, burst prematurely at about 1000 yards from the gun.

Such is the only information we have been able to obtain. We believe there were other and more conclusive experiments which led to the following report of the Commission :—

1°—The explosion of the projectile is retarded until it has attained a sufficient penetration.

2°—The projectile can be safely fired from every sort of gun.

3°—The handling of it and its preservation are free from danger.

4°—Any shell can by this method be charged with dynamite.

5°—The projectile only bursts by the action of its fuze on impact.

6°—The interior charge does not explode when the shell is struck or crossed by a projectile of small calibre.

Mr. Graydon could now consider the principle of his interior organisation of a dynamite shell well established, whatever might be the size of aërial torpedo required.

His new projectile weighs 1300 lbs., is six feet long, and contains 600 lbs. of dynamite. The pneumatic gun which throws it not being rifled, the ogival head of the shell is striated helicoidally to provide for the necessary rotation, and in rear there is a prolongation which, like a rocket-stick, steadies the shell. This prolongation consists of a series of brass cylinders telescopically fitting into one another on to the base of the shell.

They are pierced with holes so that the compressed air may penetrate and establish an equal pressure all round them. Thanks to this arrangement they open out by the force of *inertia* on the discharge of the gun and double the length of the shell.

There are several special fuzes for use with these projectiles against objects possessing high powers of resistance. One particularly interesting one for attacking the hulls of ships is an electric fuze, so arranged that the circuit is closed and the charge is fired when the projectile has penetrated to a given depth, *i.e.*, it is then subjected to the pressure of a column of water of previously determined height.

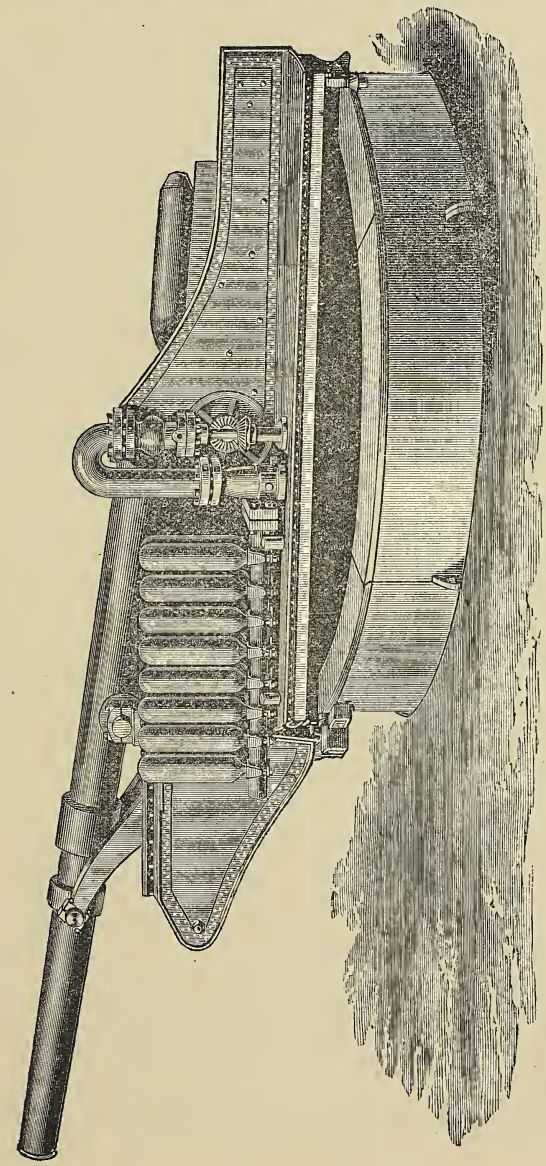
The range of the shell is three miles, and the time of flight is 30 seconds.

As regards Mr. Graydon's gun for this shell, his first one has lately been constructed by Messrs. Taunton, Delmard, Lane & Co., of Birmingham. It is a 15-inch tube of Whitworth forged steel, 24 calibres long, and weighing about 11 tons.

It is supported on its carriage by two trunnions at the breech having a diameter of one calibre, and at the chase by a collar furnished with two trunnions

attached to the carriage by two steel arms. These arms give the elevation, their lower extremities being set in motion by an hydraulic piston horizontally in the slides of the carriage.

The gun is loaded at the breech at any angle, naturally therefore at the elevation required for the work in hand. For this purpose the loading platform pivots round the breech trunnions. It is moved to a horizontal position by hydraulic power to receive the projectile brought up on a truck, it is then brought into line with the gun and the projectile is pushed into the bore. Meanwhile the breech piece—an interrupted screw—rests on a frame above the trunnions. As soon as the projectile is "home" the frame descends and the breech-piece is pushed into its place by hydraulic pistons, and the gun is "ready."



The rear trunnions are made hollow for the admission through them of the charge of compressed air. The latter is enclosed in 32 reservoirs arranged in four rows of eight, two rows on each side of the carriage. These reservoirs are four feet long, 10 inches in diameter, and ·75 inch in thickness. They are proved at a pressure of four tons per square inch, and the air in them exerts a pressure of about two and a quarter tons per square inch, a pressure at which each reservoir contains five and a half tons of air with a volume of 629 cubic yards at atmospheric pressure.

Any number of reservoirs may be discharged simultaneously according to the weight of the projectile and the range.

An automatic lubricator is fitted at the side of the firing valve whereby oil escapes into the bore and is distributed throughout its length by the compressed air.

The carriage is formed of thick steel brackets, upon which are riveted massive cast-iron supports for the trunnions. It stands with the aid of conical rollers on a circular cast-iron bed, seven yards in diameter, formed of segments built into the platform, and is moved by a compressed air machine (Heenan and Froude's) on a complete circle, so that it can be fired in any direction.

The service of the gun, laying, loading, and firing, is performed by a single man using in succession various levers. It is expected that a rate of fire of one round a minute will be attained. The reservoirs are filled by a special compression machine, a modification of those made by Mr. H. Lane for the compression of oxygen, hydrogen, and carbonic acid. The air in it is compressed in four successive periods, to each of which corresponds a piston of successively decreasing diameter: the first piston, which draws its supply from the atmosphere, has a diameter of 12 inches; the last, which forces its supply into the reservoir, has one of only two and a quarter inches. After each compression the air is cooled by a circulating serpentine of water.

In addition to the foregoing gun Mr. Graydon proposes the following pieces:—

Number.	Type.	Calibre.	Length (approximate.)	Dynamite charge.	Carriage.	Remarks.
		inches.	feet.	lbs.		
1	For gunboat of the Ammen model and for permanent works.	21	40	1200	Turret pattern with central pivot.	
2	Ships and permanent works.	17	37	900	Fixed pivot.	
3		15	34	600		
4		13	31	400		
5	Ships, siege and permanent works.	9	22	120	Fixed pivot and siege.	Revolver.
6		5	16	60		
7	Boats and field.	3	14	6	Fixed pivot and field.	Revolver.

The gunboat, for which No. 1 model has been designed, is due to Admiral Ammen of the United States Navy. She is expected to have a speed of 20 knots. She will carry four dynamite projectors in two turrets, one forward and one aft. The siege piece of nine inches will fire a round in two minutes at a range of 5000 yards.

The revolver pieces have five tubes and can fire 75 rounds a minute.

On the 12th December, 1888, the Senate of the United States voted a sum of 10 million dollars (£2,000,000) for the construction of 250 dynamite projectors for the defence of the coast. It is also believed that the British Government intends to give a trial to the system, the place of the experiment having not however been yet determined.

The Engineer states that five European States, several South American Republics, together with the Governments of China and Japan, have sent representatives to Birmingham to examine and report on the manufacture of Mr. Graydon's gun.

NOTES

FROM

CORRESPONDING MEMBERS.

THE Secretary has a few copies of the new edition of "Kane's List" which were not subscribed for. These are now on sale at £1 each.

ANY member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

THE Records of the Royal Military Academy are about to be re-published in the original form, with additions and drawings, bringing it up to date; the estimated cost will not exceed 12s. 6d. a copy.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

A NEW "Kane's List" having been recently published, and progress having been made in collating relationships of R.A. Officers past and present, Officers are requested to notify to the Secretary, R.A.I., any relationship existing between them and any other officer of the same name registered in "Kane's List."

THE subject for the Duncan Gold Medal Prize Essay, 1892, is: "Fire discipline; its necessity in a Battery of Horse or Field Artillery, and the best means of securing it.

Attention is called to the Rules for Prize Essays, &c., and Officers are asked to be careful in posting their essay intended for competition in time to reach the Secretary before the 1st of April.

COPIES of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

THE Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

THE Catalogue of Works (Authors' Index) added to the Library from 1882 to present date, is taking longer in the press than was expected, but the application of any member wanting a copy will be noted, the copy sent within a few weeks.

H.R.H. THE COMMANDER-IN-CHIEF has approved of the Annual Regimental Dinner taking place on Friday, the 10th June, 1892, at 8 p.m.

The Annual General Meeting of the R.A. Institution will probably be held in London on the afternoon of that day, and it is hoped will be succeeded by consideration of the R.A. Regimental Charities and Games' Fund.

THE 7-inch Equatorial Telescope having got out of working order, the maker, Sir Howard Grubb, has sent a skilled workman who has thoroughly overhauled and repaired it.

In consequence of his report, the Committee have given notice that the Telescope is never to be used unless Sergt.-Major Bryant or Corporal McCoubrey be present; their attendance can always be secured by applying to the Secretary, R.A.I. Both these N.-C. Officers understand the instrument, its parts and working.

Major-General F. W. Stubbs, Retired list, Royal (late Bengal) Artillery, is compiling a List of Officers who have served in the Regiment of Bengal Artillery from its first formation down to its absorption into the Imperial List.

It will consist of about 40 pages 4to, in paper cover. Price, 5s.

Any Officer who may wish to subscribe for a copy, should send his name and address to

Major-General F. W. Stubbs,
Dromiskin House,
Castlebellingham,
Ireland.

Judging from letters that have lately been filling the *Times* few would think that there are civilians in England whose one recreation and enjoyment in life is the collection of every available atom of History and Records of the British Army. Yet this is so, and it has been the privilege of the writer of this article to make the acquaintance of such a man and to inspect his treasures quite recently, and it is with a view to describe what was then shown that this is written.

In the course of a conversation on Regimental History it was casually remarked that an officer, who was compiling the history of an infantry regiment, had been referred to a certain merchant or man of business in the City, who took a great interest in military matters; further enquiries were made, and resulted in a letter of introduction to the merchant, Mr. A., who expressed his readiness to show his collection on any Saturday afternoon.

A Saturday was fixed and the writer, with a brother officer much interested in the study of the dress of the Royal Artillery, presented themselves at the hospitable house of Mr. A.

The wealth of matter displayed is almost beyond description; hearing that one of his visitors was artistically fond of the study of dress, Mr. A. produced folio after folio of water-coloured and engraved pictures of uniform, and these not for one regiment or section of the army only, but a separate folio for each; thus, for the Royal Artillery and Royal Engineers there was a large volume of two figures on each page, illustrating every known change in the dress from 1688 down to a recent date. In the same way there were separate volumes for Cavalry, Guards and Infantry. Most of the Royal Artillery are in water-colours, by Conroy, and though perhaps not very valuable as works of art are, by him, carefully painted, correct to the authority provided.

Mr. A. possesses every modern illustrated book on the army, including the popular children's publications, and has a scrap book filled with nearly 200 military Christmas cards sent to him by friends from year to year.

Among miscellaneous pictures Mr. A. has three very fine engravings showing a Pioneer, a Light Infantryman and a Grenadier of the time of the middle of the Eighteenth Century; also a set of most beautifully coloured engravings of the various historical points of the battlefield of Waterloo, and with them a picture of the Royal Artillery driving away the French guns captured at Waterloo, these are all dated 1815, with a note stating that they were from sketches made on the spot.

Of "Army Lists" Mr. A. has a splendid collection, commencing from 1755, and of works of a similar nature, but previous to this, he has calendars which contain names of field officers and stations of regiments from 1748, Millan's

"Succession of Colonels," a complete Army List in itself, 1744; the "State of Great Britain," for 1708–16–22 and other years, each containing names of field officers and stations of regiments, besides much other interesting matter; "Bulletins of Campaigns," 1793–1822; "Royal Military Calendar" (services of every field officer), 1822; "Royal Military Chronicle," 1812 to 1816; "Military Panorama," 1813–14; *London Gazette* for 1795, which contains more appointments, &c., to the army than that of any other year. Among other official works he has all the volumes but one of the "General Orders of the Duke of Wellington," unfortunately the missing volume is that for 1815: each volume is signed on the fly-leaf "Orders to be observed by ——— Army, (Sd) Aylmer, D.A.G."

He has a complete set of the "Records of Regiments," and has besides, several old monographs on various regiments, besides some most beautifully illustrated editions of "History of the Light Horse Volunteers," and similar accounts of old volunteering movements and official militia lists.

There is scarcely an English military history, magazine or record that he does not possess, and so eager is he to obtain information, that he has indexed all military matters mentioned in the "Annual Register" between the years 1758 and 1820.

Besides being a collector, Mr. A. is a writer or rather compiler of military notes, though he has no wish either to print or publish; the line in which he works is that of forming a diary from the earliest period to show each year the changes of station of every corps and regiment in the British Army; in a period of peace this was formerly but a very small matter, there being in some years as few as four changes in the whole army, but in a war the changes from day to day alone are very many, and as his wish is to be as exact as possible the magnitude of his task is something vast. Besides this he is compiling in a most thorough way a Diary of Campaigns of the British Army, commencing from 1660, and has brought this work down to 1820. As he indexes both works as he proceeds, the whole is most clear.

In making his researches and collections Mr. A. has relied entirely upon his own private efforts and judgment, and as far as could be learned has never even been in communication with officials either of the Horse Guards or War Office.

By using his own judgment, he has, in making purchases from time to time, obtained complete editions or specimen plates that are not in some of the representative collections of the nation, and he says that in trying to obtain a rare work or picture he is sometimes anticipated, not by a purchaser for the nation, but by another private collector like himself.

HALIFAX, N.S.

On 12th October Colonel G. A. Noyes was removed to half-pay after five years service as Regimental Lieut.-Colonel. Prior to his departure he was entertained at dinner by the officers of the R.A. and R.E. The Colonel-on-the-Staff proposed his health, concluding his speech with an apt quotation from Horace—"*Exegi monumentum, ore perennius*"—an allusion to the departing officer's system of command in the R.A. Halifax District. According to the time-honoured custom a model gun was fired as the toast was given. This duty is always performed by the junior R.A. subaltern present. It only takes place when a member of the Mess is leaving for good.

Halifax is one of the few stations left where a joint R.A. and R.E. Mess is still to be found. On the 21st October the officers gave their Annual Ball, which was a great success, thanks to the industry, enterprise, and originality of the Ball Committee, which was composed of Major Brady, R.A., Lieut. Enthoven, R.E. and Lieut. Elliot, R.A. The drill shed was used as the ball-room, and although this was the first time it had been put to this use the floor was the best of going,

This innovation involved the construction of 200 feet of passage way, but the extra trouble in this respect was amply compensated for by the whole of the Mess premises being available for supper and sitting out. Owing to the Ball taking place so late in the year the Mess garden could not be utilised at all, but the ever vigilant committee took advantage of the season to obtain a number of maple branches from the woods and construct a series of sitting out places with them in a building that is used on ordinary days as a "Cordage store." The glorious autumn tints on the maple leaves looked lovely, and made popular sylvan retreats for couples not dancing. A number of spruce tops were also cut and brought in from the woods round the North-west Arm, and, being stuck in tubs, materially assisted the decorations, and saved a large florist's bill for palms and plants. The ball-room, passages, &c., were lighted by the incandescent electric light, hired for the occasion. The music was supplied by the band of the 1st Battalion Leicestershire Regiment, kindly given for the occasion, and an electric bell, manipulated by the bandmaster, rang in the different rooms when another dance was about to begin.

The new organisation of the Garrison Artillery was introduced here on 1st November. At Halifax it is unique compared to any other station, as this is the only place in the whole regiment where three batteries have been amalgamated into one company. One of the results is that we lose six company officers—a Major, a Captain and 4 Subalterns—a very serious matter in a small command. The supernumerary officers have been disposed of, so far, as follows—Major Hervey to Guernsey, Captain Fell promoted to Shoeburyness, 2nd Lieut. Barnes transferred to Dover, and 2nd Lieut. Low to Jamaica. The re-organisation, as far as the new No. 3 Company is concerned, can only be partially carried out at present, as one of the batteries which is to compose it (No. 23) is still at St. Lucia, and will not be relieved until March, 1892. As soon as it arrives here Major McDonnell's Battery, which is still at Halifax, will proceed to Devonport, there to be amalgamated with what was Major Lowther's Battery, to form the new No. 17 Company. The new District Staff at this station is not crowded so far, as only two gunners have joined it up to date.

On 26th October a 12 hours mobilisation of the regular troops forming the garrison of Halifax took place. The test would have been a much better one had the Militia also taken part, but they are, unfortunately, under the orders of a Commander-in-Chief of their own, and not under the G.O.C. British Troops, who, in peace time, has no control over them. On this occasion the "regulars" manned the harbour forts and threw out out-posts on the land side. Two moveable batteries, one of six, the other of four 9-pr. R.M.L. guns paraded. Each gun was drawn by four local horses, obtained on requisition, and driven from the box by a civilian driver. The horses were attached to limbers by a wonderful system of ropes, chains and swingle-trees, known as "local draught," designed to suit the private harness, and necessitated chiefly by the absence of long traces. The officers drew horse hire for the day, the gun detachments marched on foot. Their comrades, the Royal Engineers, were conveyed to the out-posts in great style in four-in-hand hired *char-ā-bancs*, the R.E. Officer taking the box seat.

The year now coming to a close has been a good one for sport. Major McDonnell secured a fine specimen of a bull moose, whose head is now mounted and in the Mess. We will give the details from the Mess "Game Book" (a handsome volume presented by that Officer himself) which supplies a great want, and gives descriptions, statistics, expenses, photographs, &c., of all the shooting and fishing in Nova Scotia, New Brunswick, and other parts of Canada. This is the entry about the moose: "Cumberland County, N.S. In a bark camp made by Indians; 19th September, 1891. *Called* at daylight. No answer. Started after breakfast for Barn Hills' Camp. After going a mile met fresh tracks, crept up to within 50 yards of a bull, cow, and two calves, too thick to shoot and

impossible to get nearer, so I stayed where I was while the hunter went to windward of them. As soon as they winded him all four came close past me, and I shot the bull at 12 paces. Put up for the night in a 'lumber camp' a mile off, close to Atkinson's Brook.—J.M."

In August, Major McDonnell, R.A., and Lieut. Macgowan, R.A., had some fine sport salmon fishing on that queen of fishing rivers the Restigouche, which forms the boundary between New Brunswick and the Province of Quebec. In ten days they got between them 13 salmon and 3 grilse. Major McDonnell's biggest was 31 lbs. and Lieut. Macgowan's 44 lbs.—the latter is the largest salmon which has been killed in British North America with rod and line for the last six years.

On another occasion Lieut. Macgowan killed six salmon averaging 11 lbs. in one day at Indian River, only 20 miles from Halifax.

The woodcock season which has just ended has been a good one. Captain Yunge-Bateman, R.A., and another gun, shot 45 couple in a few days, and Lieut. Macgowan and another gun bagged 125 couple in 12 days.

At games the R.A. has been as successful as in sport.

A polo match was played by the R.A. against the Garrison, and won by the former by five goals to three. The sides were as follows:—

R.A.	Garrison.
Major C. R. W. Hervey,	Major Mansell, R.B.
Capt. Yunge-Bateman,	Capt. Jenkins, R.B.
Lieut. Macgowan,	Colonel Lea, D.A.A.G.
" R. E. Stuart,	Major Maycock, R.E.

In an Association Football Match the R.A. and R.E. beat the "Wanderers" (champion local team) by two goals.

In the "Garrison Miniature Rifle Club" Lieut. Marsh, R.A., made a record score of 103 points out of a possible 105 at 50, 75 and 100 yards range.

A rowing match was pulled in the harbour over a five miles course, between a R.A. crew and one from the flagship (H.M.S. "Bellerophon") which resulted in the gunners winning by 280 yards.

In an assault-at-arms which recently took place at Halifax the R.A. won the tug-of-war open to the Navy and Army.

Last month a silver challenge cup was shot for with M.H. carbines by the three batteries quartered at Halifax and won by No. 17 Battery (Major McDonnell's) Western Division.

THE ROYAL ARTILLERY STEEPLECHASES, 1892,

WILL TAKE PLACE ON THE

ALDERSHOT COURSE

(By permission of the General Officer Commanding the Division),

ABOUT THE MIDDLE OF APRIL,

(UNDER NATIONAL HUNT RULES.)

The exact date cannot now be fixed, but will be announced as soon as possible, when full programmes giving conditions of the open races, date of closing, &c., will be issued.

The following will be the only Regimental Races, as the Stewards consider it improbable that a greater number would fill. The whole are confined to horses

regularly hunted this season, and thoroughbred horses, while allowed to run in the Gold Cup, are not qualified for the Welter and Light Weight Steeplechases.

1.—The Royal Artillery Gold Cup value **100** sovs., with **50** sovs. to the winner, **20** sovs. to the second, and **10** sovs. to the third. For horses, the property of, and to be ridden by, Officers on full or half-pay of the Royal Artillery, which have been regularly hunted during the past season by their nominators or any other Officer qualified to enter. 12 st. 7 lb. each. The winner of any Steeplechase to carry 7 lb. extra; of two Steeplechases, or one value 50 sovs., 14 lbs. extra. The winner of any race value 100 sovs. excluded. Entrance 2 sovs. but starters free except the winner. 3 miles.

2.—The Welter Steeplechase of **50** sovs., with **10** sovs. to the second, and **5** sovs. to the third. For horses (not thoroughbred) the property of, and to be ridden by, Officers on full or half-pay of the Royal Artillery, or Officers who have retired from the Regiment, which have been regularly hunted during the past season by their nominators or any other Officer qualified to enter, and have never won a race of any description. 13 st. 7 lb. each. Entrance 1 sov., but starters free except the winner. $2\frac{1}{2}$ miles.

3.—The Light Weight Steeplechase of **50** sovs., with **10** sovs. to the second, and **5** sovs. to the third. For horses (not thoroughbred), the property of, and to be ridden by, Officers on full or half-pay of the Royal Artillery, which have been regularly hunted during the past season by the nominators or any other Officer qualified to enter, and have never won a race of any description. 11 st. 7 lb. each. Entrance 1 sov., but starters free except the winner. $2\frac{1}{2}$ miles.

Officers who have never won a Steeplechase under National Hunt Rules allowed 7 lb.

The Stewards reserve to themselves the right to refuse the entry of any horse that, in their opinion, has not been regularly and fairly hunted.

Major-General A. H. KING, R.A.
Lieut.-Colonel R. H. WALLACE, R.A.
Major F. W. J. EUSTACE, R.H.A. } Stewards.
Captain J. J. PORTEOUS, R.A.
Lieut. H. L. POWELL, R.H.A.

S. H. TOOGOOD, Lieut.-Colonel,
Secretary.

Kingsworthy, Winchester,
15th December, 1891.

OBITUARY.

Major-General J. L. Elgee, died at Cheltenham, 26th October, 1891. He joined the Royal Artillery 18th June, 1842, became Colonel 27th June, 1868, and retired on full pay with the honorary rank of Major-General, 19th February, 1879.

Lieut. W. H. Boyd, who died at Bhamo, Burmah, 30th November, 1891, was commissioned 29th April, 1885.

Second Lieut. W. W. C. D'O. Bignell, who died at Roorkee, 26th November, 1891, was commissioned 15th February, 1889.

DIARY OF FIXTURES.

Days of the Mth.	Week	
		JANUARY.
1	F	
2	S	
3	S	
4	M	
5	T	
6	W	
7	Th	
8	F	
9	S	
10	S	
11	M	
12	T	
13	W	
14	Th	
15	F	
16	S	
17	S	
18	M	Lecture at 9 p.m. at R.A. Institution, by Lieut.-Col. N. L. Walford, R.A., on "Swiss Artillery Practice."
19	T	
20	W	
21	Th	
22	F	
23	S	
24	S	
25	M	
26	T	
27	W	
28	Th	
29	F	
30	S	
31	S	
		FEBRUARY.
1	M	Long Course Officers and N.-C. Officers Garrison Artillery begins.
2	T	
3	W	
4	Th	
5	F	
6	S	
7	S	
8	M	
9	T	
10	W	

FEBRUARY.—*Continued.*

Days of the Mth.	Week	
11	Th	
12	F	Kempton Park Meeting (2 days) begins.
13	S	
14	S	Sandown Park First Spring Meeting (2 days) begins.
15	M	
16	T	
17	W	R.A. Band Concert at Woolwich at 3 p.m.
18	Th	
19	F	
20	S	
21	S	
22	M	
23	T	
24	W	R.A. Band Concert at Woolwich at 3 p.m.
25	Th	
26	F	
27	S	
28	S	
29	M	

MARCH.

1	T	
2	W	R.A. Band Concert at Woolwich at 9 p.m. Sacred Music.
3	Th	
4	F	Sandown Park March Meeting (2 days) begins.
5	S	
6	S	
7	M	
8	T	
9	W	R.A. Band Concert at Woolwich at 3 p.m.
10	Th	
11	F	Grand Military Meeting Sandown Park (2 days) begins.
12	S	
13	S	
14	M	
15	T	
16	W	R.A. Band Concert at Woolwich at 9 p.m.
17	Th	
18	F	
19	S	
20	S	
21	M	Lincoln Spring Meeting begins.
22	T	
23	W	R.A. Band Concert at Woolwich at 3 p.m.
24	Th	Liverpool Spring Meeting begins.
25	F	Grand National.
26	S	
27	S	
28	M	
29	T	
30	W	R.A. Band Concert at Woolwich at 3 p.m.
31	Th	

PRÉCIS
AND
TRANSLATIONS.

"REVUE D'ARTILLERIE."

FISKE'S TELEMETRIC AND POINTING INSTRUMENTS.

BY

G. MOCH.

(Capitaine d'artillerie, Adjoint à la Section technique de l'artillerie).

TRANSLATED BY

Lieut.-Colonel F. E. B. Loraine, *late* R.A.

In submitting to the Committee and to the readers of the R.A.I. "Proceedings" the subjoined article by Captain Moch, I beg to state that the Commandant Grillot, Chef d'escadron d'artillerie, and Director of the *Revue d'Artillerie*, has been beyond measure kind in lending gratis, for the purposes of this translation, the stereotype plates which served for the illustration of the original article. I beg here to tender to that distinguished officer my warmest thanks for his courtesy and generosity.—*F.E.B.L.*

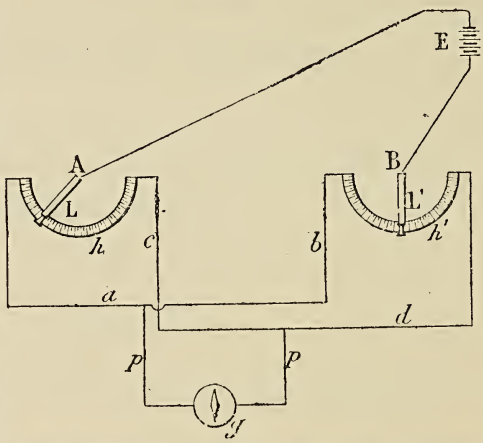
Captain Moch has borrowed his descriptions of the above instruments from "The United Service Gazette," "The Electrical Engineer" (of New York), "La Lumière Electrique," "Engineering," the official report of experiments carried out on board the United States cruiser "Baltimore," and finally and principally from personal communications with the inventor, Captain Fiske, United States Navy. The first of the instruments in point of date were two range-finders, or, as the writer prefers to call them, telemeters, for use on board ship, but which are equally adapted for coast defence or siege work. Then Captain Fiske produced a position-finder, which gave the distance from the battery to the object, and the position of the latter on a chart. Finally, by developing his system, he arrived at laying electrically, from the centre point of observation, guns which were firing at objects unseen from their emplacements. Captain Fiske's inven-

tions are known to the Lords of the Admiralty, and it is understood that they will before long be subjected to competition with the system of other inventors before anything is fixed in regard to naval range-finding.

I. General Principle of the Instruments.

The general principle is an ingenious application of Wheatsone's Bridge,[1] and consists in determining *at a distance* the angle of inclination to one another of two needles fixed at points widely separated, or, on the other hand, in making the two needles parallel. For that purpose, two metallic needles, L and L′ are pivoted on the vertical axes A and B. Their free extremities are in contact with two metallic arcs of a circle, *h* and *h′*, which are attached to one another by two weak conductors *ab* and *cd*. These conductors are attached to one another by a transverse wire *pp*, of the same conductivity, which in its turn is surmounted by a *dead-beat*[2] galvanometer *g*. The pivots of the needles are united respectively to two poles of the accumulator E. The current, on arriving at one of the pivots, follows the corresponding needle and divides itself on the arc into two parts which reunite on the other needle. This circuit constitutes therefore a Wheatstone's Bridge, in which the resistances of the four portions vary with the deflection of the needles, since every movement of one of the latter introduces into the circuit a greater or less portion of the corresponding arc.

Fig. 2.



When the needles are parallel their extremities touch homologous points on the two arcs, and each circuit derived from those points, on one and the other

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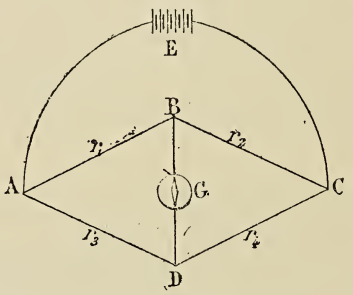
[1] Wheatstone's Bridge is theoretically represented in this figure, where E is the battery and G a galvanometer. If r^1, r^2, r^3 and r^4 represent respectively the resistances of the wires or coils AB, BC, AD and DC of the Bridge, and if these resistances be such that no current passes through the galvanometer in the direction BD, we have the equation:

$$r^1 r^4 = r^2 r^3$$

Let us, then, so arrange matters as to have two standard resistance coils in AB and AD, of which we know the ratio, and a coil of variable resistance in BC. Then vary the resistance of the latter until no current passes through BD, when we shall be able to measure the resistance of CD, the quantity required, by

$$r^4 = \frac{r^3}{r^1} r^2$$



[2] A *dead-beat* galvanometer or ammeter, as it is frequently called, is one with a very light needle moving in a very powerful magnetic field. The moment of *inertia* of the light needle being very small, its oscillations are very quick and die out very rapidly, so that if the current that is being measured has a sudden change in its strength, the needle moves sharply from one point of the scale to another point, where it stops dead, or *dead-beat*. This decisive action of galvanometers with light needles renders them particularly suitable for artillery purposes. A *dead-beat* galvanometer has moreover the advantage of giving correct reading in any position, provided that its needle be well balanced.—*F.E.B.L.*

side of the transverse wire, has the same length of conductor. Hence no current passes through the transverse wire and the needle of the galvanometer is at zero. If one of the needles be deflected the segments of the arcs included in the circuit are no longer equal, the equilibrium is disturbed, and the galvanometer reveals the passage of a current through the wire *pp*.

Inversely, if the needles were in the first case at a certain angle, one to the other, and were moved till they were parallel, the current in the galvanometer would diminish and would be *nil* as soon as parallelism was effected.

In all Captain Fiske's instruments it is assumed that the electromotive force of the source of electricity is constant, likewise its interior resistance and that of the circuits. With the accumulators he employs that hypothesis is practically exact for a period of at least 24 hours, as has been shewn by experiment. As none of the instruments are worked continuously, that period suffices for a large number of observations without re-charging the accumulators.

II. Telemeters.

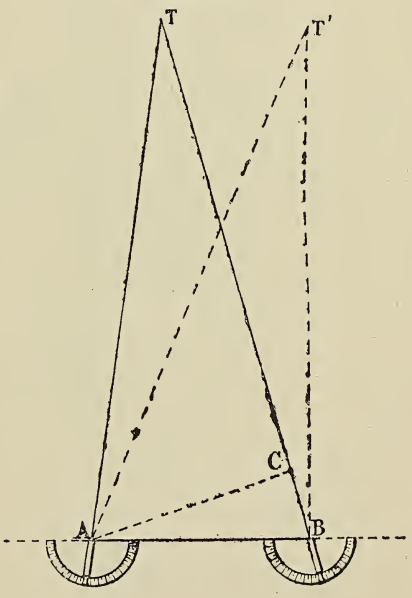
The two successive instruments of this character were called the "Slide Range-Finder" and the "Automatic Range-Finder." In principle both these instruments consist of two telescopes mounted at the two extremities of a known base upon a circuit, arranged, as already explained, as a Wheatstone's Bridge. Each of these telescopes turns upon a pivot above a horizontal plate, and is movable in the vertical plane to admit of being pointed in any direction. Upon the horizontal plate and round the same pivot turns a metallic needle, of which one extremity moves upon the conducting arc included in the circuit, and which follows the movement of the telescope in the same vertical plane. When the two needles, and in consequence the vertical planes of the two telescopes, are parallel, the galvanometer is at zero.

If then T (*Fig. 3*) be the object and AB the base, the needle of the galvanometer will furnish by its deflection the angle of the object, or parallax, ATB. A second angle ABT being read at the other telescope, we obtain the distance from the equation:—

$$AT = \frac{AB \sin ABT}{\sin ATB.}$$

by means of tables arranged in functions of the two angles.

Fig. 3.



The inventor subsequently contrived in the following manner to save himself from the obligation of measuring the angle ABT. Now when the object is at T', so that ABT' is a right angle, the sin ABT' is unity, and a knowledge of the parallax AT'B is sufficient for our purpose.

In the case of an object situated obliquely at T let us call α the angle T'BT which the normal to the base makes with the line of sight, and draw AC at right angles to BT. Then

$$AT = \frac{AC}{\sin. ATB} = \frac{AB \cos. BAC}{\sin. ATB}$$

but the angle BAC=TBT=α. Let b be the base, d the distance, and γ the parallax. Then we have

$$d = \frac{b}{\sin.\ \gamma} \cos.\ \alpha = b \operatorname{cosec.}\ \gamma \cos.\ \alpha$$

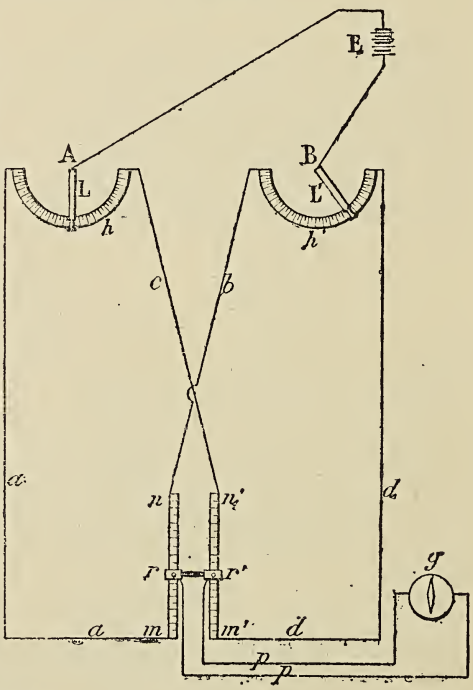
That is to say that the distance of an oblique object varies for the same parallax with the cosine of the angle α, or azimuthal angle of the object, to continue to borrow the convenient terms of astronomy.

The Fiske range-finders are arranged so as to record the quantity b cosec. γ, which, in the case of a line of sight normal to the base, is the range itself. For the ordinary case of an object situated obliquely the instrument itself makes the correction by multiplying the above value by cos. α.

The Slide Range-Finder.

This apparatus is represented theoretically by Fig. 4. At the extremities A and B of the base are the telescopes L and L′ which slide round the conducting arcs h and h' and which are connected together by the Wheatstone Bridge *abcd*, into the circuit of which are introduced two parallel bars, *mn* and *m′n′*, of equal resistance. Upon the bars runs a slide, of which the extremities, r and r', isolated from one another, carry the terminals of the two poles of the transverse wire. When the slide gives electric contact to the two bars the resistances of the latter are divided equally between the four sides of the Bridge, and there is equilibrium if the telescope needles are parallel. But when the slide is moved, a variation in the resistances of the four sides of the Bridge is effected, and consequently a variation of intensity in the current of the transverse wire. If the movement of the slide be regulated, the current developed in the transverse wire, by the convergence of the telescope needles on the object, may be annulled; and we can conceive the possibility of graduating the bars of resistance so that the position of the slide at the moment when that effect is obtained shall indicate the angle of inclination of the two telescopes, *i.e.*, the parallax, or apex angle, required.

Fig. 4.



In order to grasp the matter more closely, let us suppose that the bars have the same resistance as the arcs and are graduated in divisions of the same length. If we move the slide n divisions, we shall introduce into the circuit, on one side of the transverse wire, the length n of each bar, or a total resistance of $2n$, and we can fix the telescope L′ with a compensation of magnitude $2n$ in regard to its needle.

In a general sense, that is to say, without making any particular hypothesis about the relative resistances of the bars and the arcs, the movement of the slide

which brings the galvanometer to zero is proportional to the length of the arc h traversed by the telescope L′ from the position of parallelism to L.

Now the angular traverse of the telescope is equal to the parallax; on the other hand, the smallness of this angle permits of its being represented by its sine, as will be done frequently in the following pages; and it will be admitted that the distance moved by the slide on the bars is proportional to the sine of the parallax. Let us express that thus:

$$n = \mathrm{K} \sin.\ \gamma, \text{ whence } \sin.\ \gamma = \frac{n}{\mathrm{K}}$$

In the case of a line of sight normal to the base we have

$$d = \frac{b}{\sin.\ \gamma} = \mathrm{K}\frac{b}{n}$$

The distance is therefore inversely proportional to the length n, and can be directly read on a graduation traced on the bars. But in the case of an ordinary line of sight which is oblique to the base we have seen that

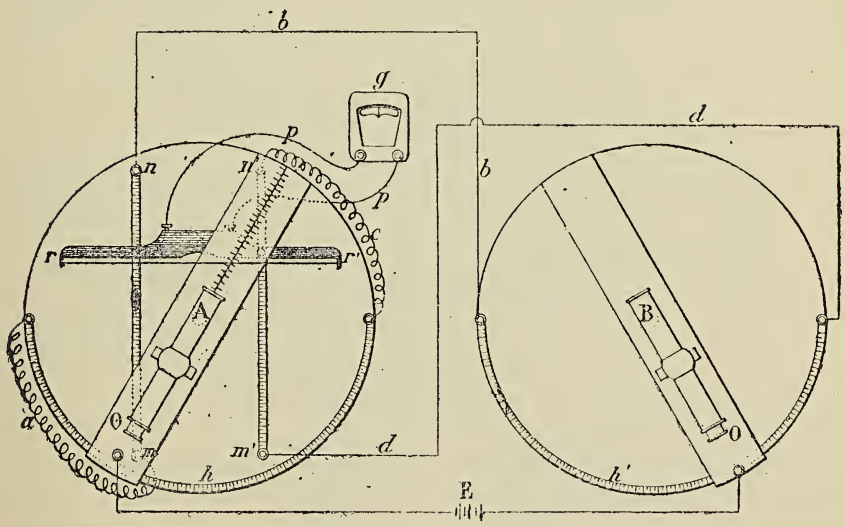
$$d = b \text{ cosec. } \gamma \cos.\ \alpha$$

$$\text{whence } d = \mathrm{K}\frac{b}{n}\cos.\ \alpha$$

A graduation of the bars will therefore only give the distance within the approximation cos. α.

The necessary correction is made as follows by the instrument itself (Fig. 5). The bars of resistance mn, $m'n'$, are placed upon the same plateau as one of the

Fig. 5.



telescopes, one on each side of the pivot, and normally to the base; the graduation in successive values of b *cosec.* γ is traced, not on the bars, but on the telescope needle. The needle is then moved by the telescope till it is in the same vertical plane as the optic axis, making with the bars of resistance an angle equal to α, the azimuthal angle of the object. The guide-line of the slide, the

line rr', horizontal and parallel to the base, intercepts the graduation at a distance n' from the origin, equal to $\frac{n}{\cos.\ a}$. Substituting this value in the foregoing equation for distance we have

$$d = K\frac{b}{\frac{n'}{\cos.\ a}}\cos.\ a = K\frac{b}{n'}$$

We see thus that if the movement of the slide is made dependent, not on the bars of resistance, but on the needle which is inclined to them at the angle α, that movement is always inversely proportional to the distance. In other words a graduation, in functions of b cosec. γ, traced upon the needle, will give the distance for every line of sight.

The practical working of the instrument is as follows: two observers, having agreed on a signal, point both the telescopes at the object; a third one moves the slide till he brings the needle of the galvanometer to zero, and then reads off the distance at the point where the guide-line of the slide crosses the graduation of the telescope needle.

The Automatic Range-Finder.

In this improved telemeter Captain Fiske has succeeded in obviating all manipulation, and the range is read on the face of the galvanometer. In the case where the line of sight is normal to the base we have already seen that the distance is inversely proportional to the parallax (or more strictly speaking its sine), and consequently also to the displacement of the galvanometer needle.

Where the line of sight is oblique to the base we have also seen that the range varies for the same parallax as the cosine of the azimuthal angle. If then the deviation of the galvanometer were constant for the same parallax, whatever the direction of the line of sight, the graduation on its face would only be correct for the normal case. But it is not so. In such cases the intensity of the current which passes through the galvanometer increases with the azimuthal angle of the object. (A calculation of the resistances of the four parts of the Wheatstone's Bridge, set forth in "La Lumière Electrique," tome XXXIX., p. 155, demonstrates the above fact.) With the increased current comes an increased deviation of the galvanometer, *i.e.*, a diminution of the range read upon that instrument. It will be remembered that the reading zero corresponds to the parallelism of the telescopes, *i.e.*, to an infinite range. In other words, the increase of current which results from the increase of the azimuthal angle, tends of itself to compensate the error due to the obliquity of the line of sight. If the intensity of the current which passes through the Bridge were exactly in inverse proportion to the cosine of the azimuthal angle, that compensation would be constant, and the graduation of the galvanometer for range would be exact in all cases. In point of fact a calculation of the intensity of the current in the transverse wire of the Bridge gives the three following results:—

1°—The intensity of the current cannot be made rigorously proportional to the inverse of the cosine, or secant, of the azimuthal angle.

2°—The resistances can be regulated for a particular azimuthal angle, whatever the range. That being so, the graduation of distances on the galvanometer which accords with normal lines of sight, accords also with the lines of sight in the direction α, and if this angle α be suitably chosen the errors due to the graduation for intermediary lines may be disregarded.

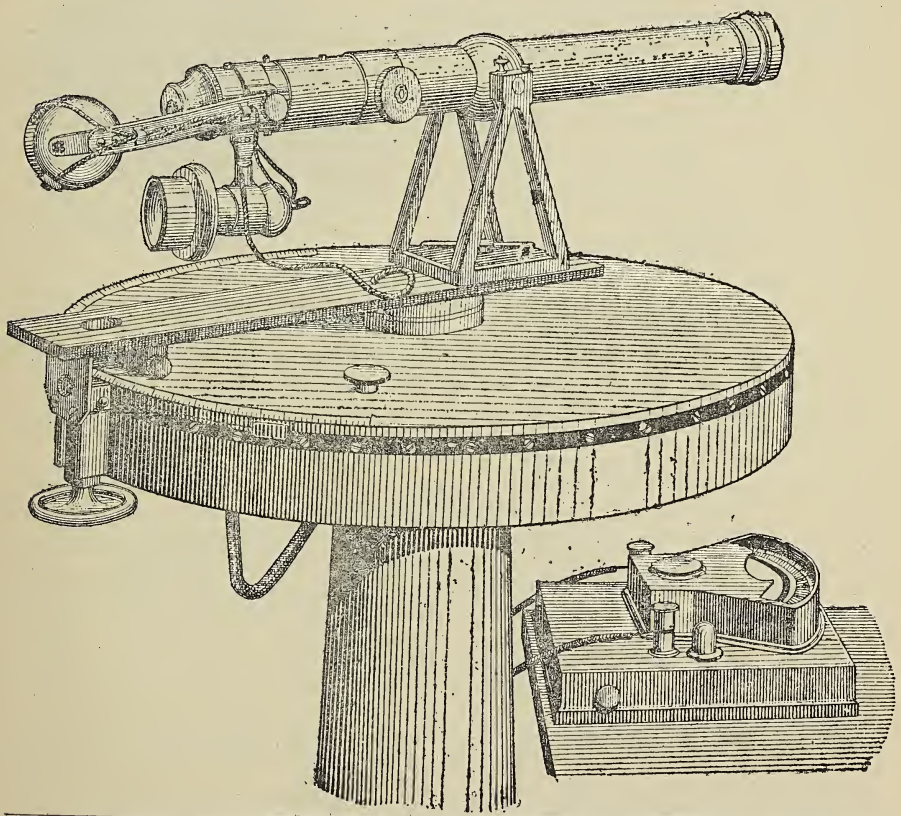
3°—This result is effected by giving the two metallic arcs a circular meaurement inferior to 180°; thus, when they are about 167°, the indications of the range-graduated galvanometer are rigorously exact at 45° on either side of the normal to the base, which corresponds therefore to a field of 90°. It is this measure of 167° for the regulation of the electric current which has been adopted by the inventor.

We shall see presently that experience has confirmed the accuracy of his calculation.

The working of the Automatic Range-Finder is most simple. The apparatus comprises two telescopes with alidades or needles (Fig. 6) installed at the posts of observation, and a graduated galvanometer placed near the commander of the guns, or else at the observatories, which simplifies the transmission of orders. The latter is the case in the sketch where we see the galvanometer close to the telescope. The three posts are united by telephone connected with the same circuit, and so arranged that an observer has his eye on the telescope, the receiver against his ear, and the transmitter before his mouth. When the two telescopes are exactly on the object the range is read on the galvanometer.

As during the movements of a ship it will be impossible for the two telescopic observers to be constantly "on" the object, they are supplied with electric-bell calls, within reach of their hand, which they ring every time they are "on." When the commander of the guns hears the two bells simultaneously he reads the galvanometer.[1]

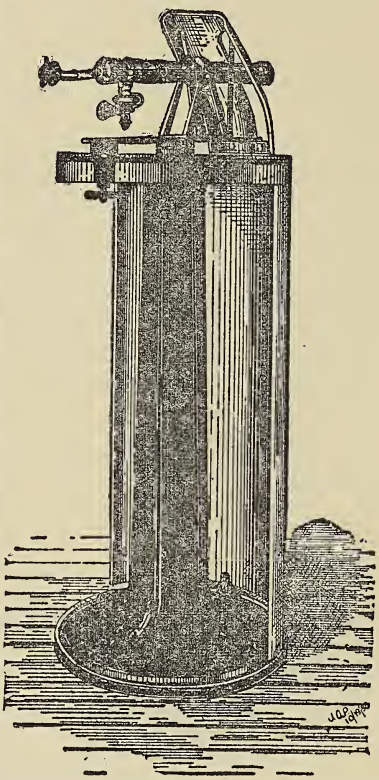
Fig. 6.



[1] This will remind some of my contemporaries of our range-finding at moving objects at Aldershot with Colonel Nolan's excellent instrument so long ago as 1865.—*F.E.B.L.*

Figure 7 represents one of the instruments as installed on board ship. The only protection accorded to it is a cover for the telescope when not in use. The apparatus is made of iron and aluminium bronze, with a wrought-iron shield to protect the observer from rifle fire. Water, even a green sea, has no effect on the galvanometer. The total resistance of the circuit is in fact only 1·5 ohms, whereas salt water has a resistance so far superior that it is not likely to cause any deflection of the needle.

FIG. 7.



The graduation is made up to 30,000 yards, or about 17 miles, to admit of observations being made by a cruiser at the extreme limit of view.

In experiments made on board the French barbette ship "Formidable" the distances were measured to ships moving at varied speeds from 0 to 28 knots; in the most difficult cases the error was less than 5 per cent. of the range, the base being 69 metres. The error is much less with a fixed object, viz., about 3 per cent. A heavy sea naturally affects the observations, but not so much as it affects the laying of the guns. The instrument may be very useful at night, the flash of a gun discharge possibly sufficing to measure the range of the ship which fired it.

Combined with a sextant the telemeter can determine the height of an enemy's mast. This knowledge might be very useful in the event of the telemeter being damaged in the course of an engagement.

The United States cruisers "Baltimore" and "Chicago" have both been fitted with automatic range-finders. The "Baltimore's" report of the 21st January, 1891, gives an account of many experiments during a cruise of several months. The greatest error recorded was one of 700 yards on a distance given by a chart as 15,600 yards, or less than $4\frac{1}{2}$ per cent. At such a great distance more accuracy is scarcely attainable, owing to the extreme fineness of the graduation, which becomes more and more difficult to read as the distance increases. But at high gun ranges, such as 5000 yards, the mean error is only ·33 per cent., or $16\frac{1}{2}$ yards.

In these experiments the results were gauged on a large chart, but the mere displacement of a ship at anchor by the action of tide and current causes more variation of range than the errors of the instrument. However this influence was eliminated in an experiment made at Spezia on the 18th December, 1890. The "Baltimore" was anchored between the Fort Santa Maria and a lighthouse, and on their alignment. The distances between the ship and each of these points were measured, twelve times to the fort and eight times to the lighthouse. The mean measurement to the fort was 3486 yards, with a mean error of 35 yards; to the lighthouse 1074 yards, with a mean error of 1 yard. So that, according to the telemeter, the distance between the fort and the lighthouse was 3486 + 1074 = 4560 yards, whereas the chart gave it 4580 yards: mean error 20 yards, or ·43 per cent.

On the 14th January, 1891, in the roads of Villefranche, the "Baltimore" practised at ranges of 850 and 1400 yards with good effect, the elevation being in

all cases taken from the telemeter. In calm weather it was found easy to keep the telescopes on vessels moving at the highest speed, but in rough weather the electric bells had to be used. Rolling and pitching had no effect on the galvanometer, nor was the telemeter in any way affected by the discharge of 8-inch guns in its immediate proximity.

In the "Baltimore" one telescope is placed forward, the other aft, with a base between them of 92 yards. The instruments can be pointed either to starboard or port, and turned from one direction to another in about 15 seconds. In March last, at Spezia, the Italian ironclad "Terrible" (a central battery ship of the "Warrior" type, only 64 metres long) carried out some practice with Fiske's Automatic Range-finder with the following results:—

Range in metres.	Mean error in metres.	per centage of distance.
1565	18	1·22
1950	24	1·23
2290	32·5	1·45
2978	58	1·90
3240	68	2·10
3610	40	1·10
3880	28	·70

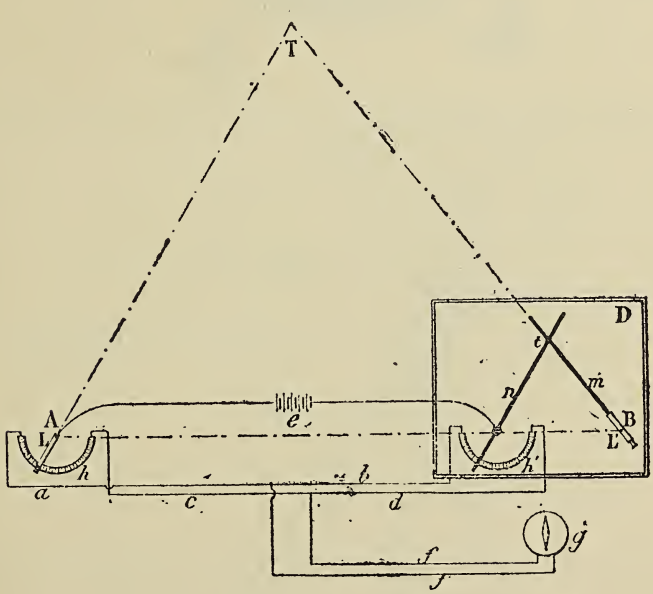
The length of the base was only 58·9 metres.

The Italian Experimental Committee gave it as their oponion that the errors would almost have been reduced by half if the base had been 100 metres, as would be possible in a modern ship.

III. Position-Finder.

The Position-Finder sets off the position of an object on a chart. It comprises two observatories, marked upon the chart, and a central post, where the triangle is set off, or else simply two observatories as represented in Fig. 8. Each obser-

Fig. 8.



vatory has a telescopic needle attached by a Wheatstone's Bridge to a simple needle at the central post. These two needles are placed upon the precise points of the chart which correspond to the two observatories. The telescopes being laid on the object, the needles at the central post are turned by hand till their

corresponding galvanometers are at zero. When that occurs these two central needles are parallel to those of the telescopes to which they are attached. Prolongations of the needles over the face of the chart indicate by their intersection the position of the object.

The plan (fig. 8) gives a clear idea of the manipulation. The telescope L′ is directed on the object T. The central post needle n is, by means of the Wheatstone's Bridge *abcdfg*, brought parallel to the telescope L. The intersection of n and m (the prolongation of L′) at t is obviously the position required.

Figure 9 gives the telescope L′ and the chart in elevation.

Fig. 9.

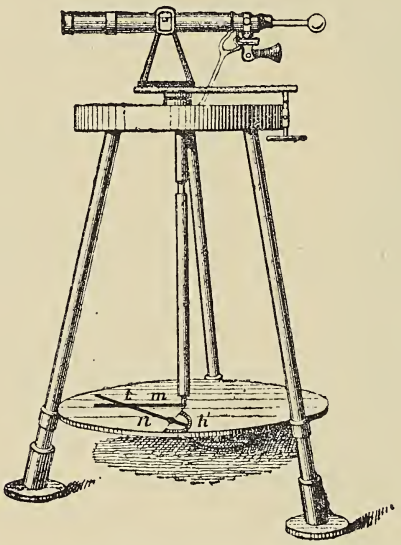
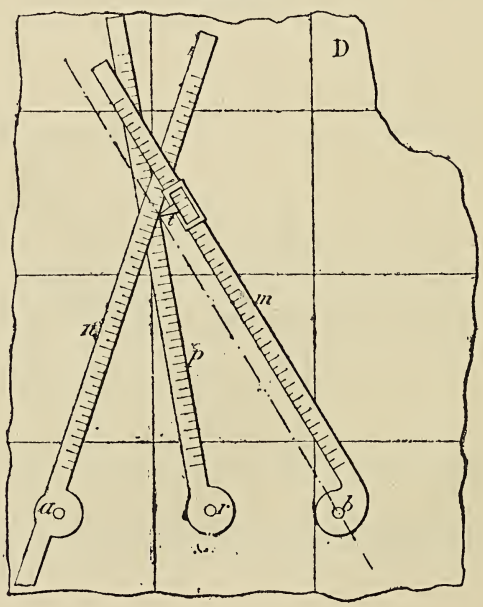


Figure 10 shews the practical arrangement of the plotting scales n and m. To

Fig. 10.

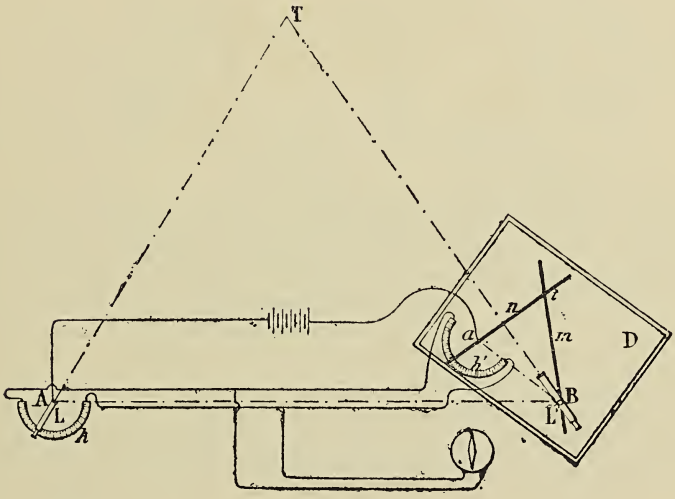


avoid any uncertainty due to their thickness, the scale n is pivoted on the prolongation of its graduated edge, and the sliding index of the scale m has its point running parallel to the scale, and passing through its pivot as shewn by the dotted line. A third scale, p, may be employed for measuring the range, the point r being the position of the battery.

One of these position-finders is installed at Fort Hamilton, in the roadstead of New York. For two months it has remained exposed to the weather without any covering, and subsequent thereto has given a series of ranges from 2000 to 5500 yards, with a mean error of ·33 per cent., the base being 270 yards.

The theoretical figure 11 applies to the case where, for whatever reason, the chart D is placed with one side at an angle to the base, instead of parallel to it. The base AB is then represented by the line aB. We readily see that, in order to apply the rules we have already examined, it will suffice for the telescope L′ and its scale m to be placed at an angle in horizontal projection equal to that between the lines AB and aB. The triangle atB of the chart will be similar to the triangle ATB in space when the galvanometer marks zero, this similitude depending in reality, not on the parallelism of the scale n and the telescope L, but on the equality of the angles which they intercept on their corresponding arcs, the arc h' being a fixture on the chart.

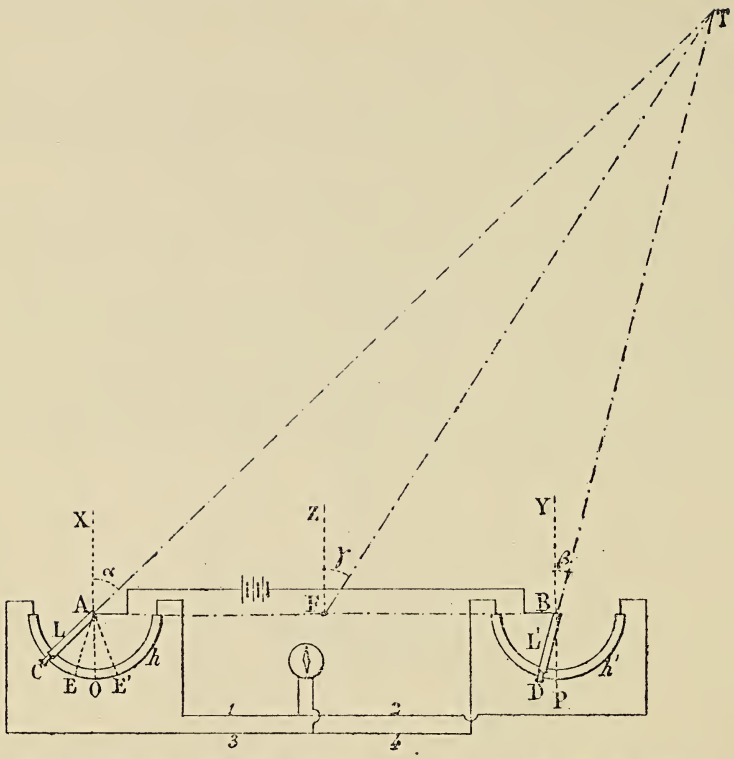
Fig. 11.



IV. Telemetric Position-Finder.

Captain Fiske's most recent improvement, not hitherto published, consists in adapting his automatic range-finder to the finding of a position. He unites the two telescopes by a second Wheatstone's Bridge which gives the direction, whilst the first one continues to measure the range. This arrangement is obviously of great utility for indirect fire. Let L and L′ be the two telescopes, installed at the observatories A and B (Fig. 12), and moving round the conducting arcs h and h'.

Fig. 12.



These are all connected by the Wheatstone's Bridge 1 2 3 4, and with the galvanometer G. Let CA and DB be the positions of the telescopes when pointed at the object T; let EA be the position of L when parallel to DB; and OAX PBY be normals to the base; let the azimuthal angles of the object at A and B be XAT=α and YBT=β. When the telescopes follow the lines EA and DB the galvanometer is at zero; and if L be pointed at the object, following CA, the deviation of the galvanometer measures the arc EC, whence, as we have seen, the range can be deduced.

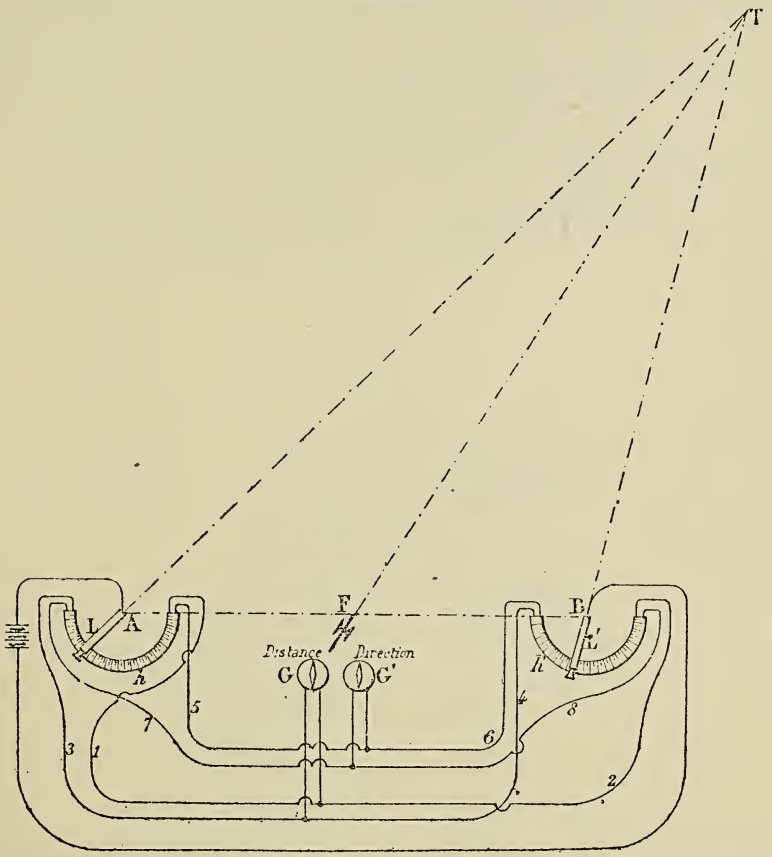
Suppose, now, that we turn the arc h 180° round the axis OX, we shall have E at E′, so that henceforward the galvanometer shall be at zero when L is at E′A. If then we point L at the object, following the line CA, the deviation of the galvanometer will be proportional to the arc CE′, *i.e.*, to the sum of the azimuthal angles, $\alpha+\beta$. That sum can be read on the galvanometer, or $\frac{\alpha+\beta}{2}$, the mean of the two angles.

Take F in the middle of the base, and we may say, with sufficient exactitude, that the azimuthal angle γ at that point is equal to $\frac{\alpha+\beta}{2}$. The slight error involved consists in taking the line TF, which divides the triangle ATB into two equal parts, as coincident with the bisector of the angle ATB. As this angle never exceeds 3° the error involved is only 2′. If then a gun be situated at F

the galvanometer, which in the first position of the arc h gave the range, now gives the direction.

The following ingenious artifice produces these results without turning the arc h round the axis OX (Fig. 13.) In point of fact it suffices to reverse the wires of

Fig. 13.



the Wheatstone's Bridge, with the result that the galvanometer then reads the sum, and not the difference, of the azimuthal angles. To effectuate that, the two arcs are connected by two Bridges, of which the first, 1 2 3 4, is installed in the ordinary manner, *i.e.*, so as to establish communication between the homologous extremities of the arcs, and with its galvanometer G, placed at the gun, and graduated for distance. The second Bridge, 5 6 7 8, connects the left extremity of the arc h to the right extremity of h', and reciprocally; its galvanometer G', also at the gun, measures the sum $\alpha+\beta$, and is graduated in values of $\frac{\alpha+\beta}{2}$. That is to say, that in this case we read at the gun the direction, and with the other Bridge the range.

The middle point of the base has only been selected for convenience of demonstration. It would be easy to determine between what limits the battery could be suitably placed, and in particular, we should improve the accuracy of the direction in bringing the battery to the point where the bisector of the apex angle meets the base, that is, towards the observatory B, which is the nearest to the

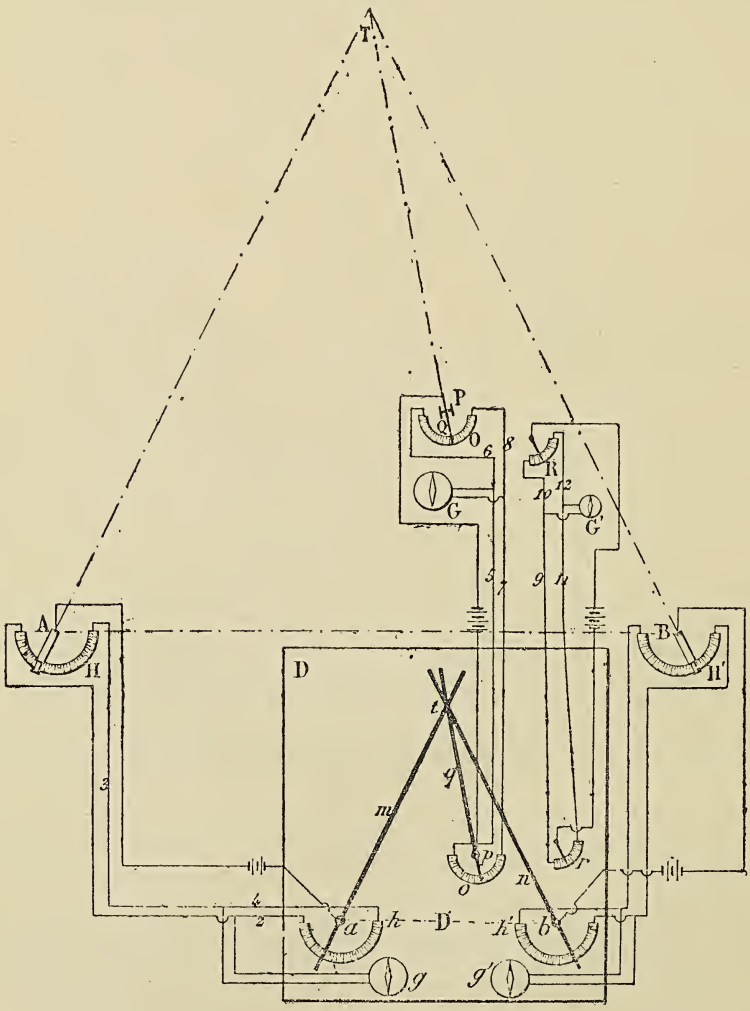
object. If also the battery is not exactly on the base, the galvanometer will shew a slight constant error, which can be rectified beforehand by special adjustment.

V. Electric Apparatus for Indirect Laying.

In figure 14, let P be the gun ; T the object, visible only from the observatories A and B ; and DD the chart representing these four points, and itself situated either at A or B, or elsewhere. The arcs H and H′ have the same resistance as *h* and *h′* on the chart. The scales *m* and *n* are to be made respectively parallel to the telescopic needles at A and B. For that purpose the arcs H and *h* are connected to an electric battery, and to the galvanometer *g*, by the Wheatstone's Bridge, 1 2 3 4, in such a manner as to bring the galvanometer to zero by means of the parallelism of *m*, and the needle and telescope at A. A reciprocal arrangement connects H′ and *h′*.

When then both the galvanometers are at zero, and the telescopes are on the object, the intersection of *m* and *n* gives the position of the object on the chart.

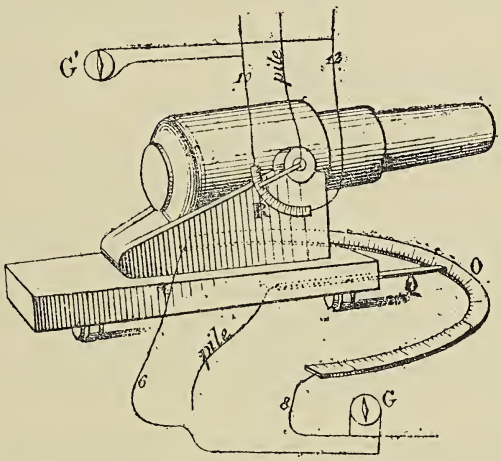
Fig. 14.



At p on the chart there is a small scale q, of which the free extremity slides upon the conducting arc o.

Near the gun itself, at P, there is another arc O, and scale Q, solidly attached to the gun. O and o are connected by the Bridge, 5 6 7 8, so that the galvanometer G is at zero when Q is parallel to q. Therefore when the position of the object has been marked on the chart the scale q is passed through the point indicated, and the gun, with Q attached to it, is traversed until the galvanometer G marks zero. The gun is then pointing at the object. The angle of elevation may be telephoned to the gun, or else transmitted electrically by means of the quadrants R and r, the Bridge 9 10 11 12, and the galvanometer G′. The same observatories and the same central post may serve several batteries. It will only be necessary to indicate their positions on the chart, and have a scale for each. Fig. 15 represents the arrangement of a gun with the above apparatus. The scale Q is firmly fixed to the centre of the gun carriage, and is therefore in the same vertical plane as the axis of the piece. The quadrant R is fixed to a bracket of the gun carriage, and its index to a trunnion. Elevation or depression is then given until the galvanometers G and G′ are both at zero.

Fig. 15.



VI. Telescope for Laying Ship Guns.

This invention of Captain Fiske's has no scientific connection with the preceding ones. It is represented in the figures 16 and 17, and consists of a telescope which turns upon a stand, and is held by a spiral spring in contact with an adjusting screw, by means of which the axis of the telescope can be made to rest at any angle to the deck of the ship.

Fig. 16.

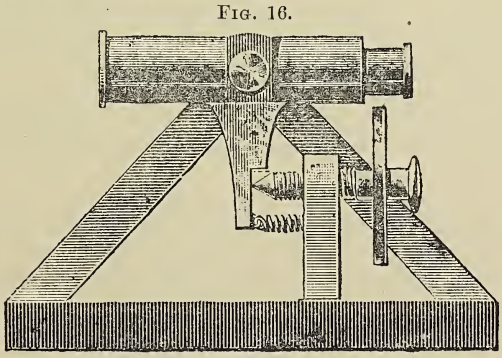


Fig. 17.

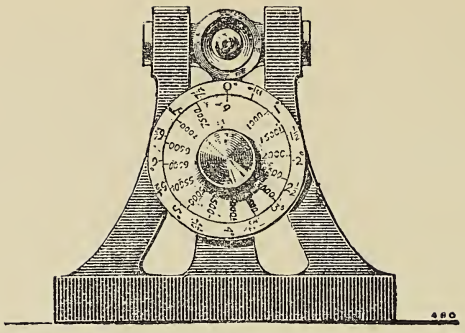
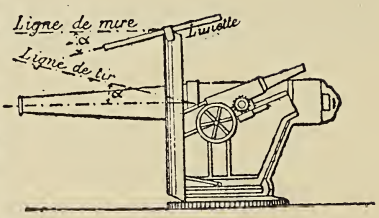


Fig. 18.



In Figure 18 we have a gun protected by a shield which turns with it, and to which the telescope is attached, on one side of and parallel to the gun. The screw is adjusted so that its graduation is at zero when the gun platform and the telescope are both horizontal. In the same way, the positions are marked beforehand for various elevations, for which under the same conditions the gun is horizontal, *i e.*, parallel to the telescope. If now we desire to shoot at an angle α, while a ship is rolling, we place the gun at the marked position, bring it parallel to the platform, and we move the adjusting screw till the telescope makes the angle α with the platform. The commander of the gun, holding with his left hand a convenient handle, easily keeps his eye at the telescope. When the optic axis passes through the object, the gun makes the angle α with the horizon, and the commander fires with his right hand. If the rolling of the ship be inferior to the angle α the gun is laid at an angle with reference to the deck of the ship, at most, equal to the angle of rolling, by means of the marked graduation referred to above, and the complement is given to the telescope. For instance, if the required elevation is 6°, and the angle of rolling 4°, we lay the gun at 4° to the deck of the ship, and the telescope at—2°.

For night-firing the telescope is provided with cross-wires which can be made incandescent by means of a current, a process often adopted in astronomy. This telescope has given good results on board the United States cruiser "Yorktown." Another one is on trial on board the French barbette ship "Formidable."

VII. Résumé.

Excepting the telescope for laying ship guns, the divers inventions of Captain Fiske's are closely allied. They mark, as they progress, a series of improvements and simplifications of the same idea, starting with the Slide Range-Finder, now abandoned by its author, and which has only been described here to facilitate the descriptions of its successors founded on the same principle.

The Automatic Range-Finder has been well received everywhere. It is of course suitable for coast defence or siege works as well as for ships. It admits of great latitude in the selection of a base which may be small, or vertical, or sloping at any angle.

As regards the electric apparatus for indirect laying, it seems doubtful whether recourse will ever be had to such a complicated system of electric communications. But the common principle of a peculiar adaptation of Wheatstone's Bridge, to correct the solution of an oblique-angled triangle, is very ingenious.

NOTES

FROM

CORRESPONDING MEMBERS.

THE Secretary has a few copies of the new edition of "Kane's List" which were not subscribed for. These are now on sale at £1 each.

ANY member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

THE Records of the Royal Military Academy are about to be re-published in the original form, with additions and drawings, bringing it up to date; the estimated cost will not exceed 12s. 6d. a copy.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

A NEW "Kane's List" having been recently published, and progress having been made in collating relationships of R.A. Officers past and present, Officers are requested to notify to the Secretary, R.A.I., any relationship existing between them and any other officer of the same name registered in "Kane's List."

THE subject for the Duncan Gold Medal Prize Essay, 1892, is: "Fire discipline; its necessity in a Battery of Horse or Field Artillery, and the best means of securing it.

Attention is called to the Rules for Prize Essays, &c., and Officers are asked to be careful in posting their essay intended for competition in time to reach the Secretary before the 1st of April.

COPIES of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

THE Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

THE Catalogue of Works (Authors' Index) added to the Library from 1882 to present date, is taking longer in the press than was expected, but the application of any member wanting a copy will be noted, the copy sent within a few weeks.

H.R.H. THE COMMANDER-IN-CHIEF has approved of the Annual Regimental Dinner taking place on Friday, the 10th June, 1892, at 8 p.m.

The Annual General Meeting of the R.A. Institution will probably be held in London on the afternoon of that day, and it is hoped will be succeeded by consideration of the R.A. Regimental Charities and Games' Fund.

Major-General F. W. Stubbs, Retired list, Royal (late Bengal) Artillery, is compiling a List of Officers who have served in the Regiment of Bengal Artillery from its first formation down to its absorption into the Imperial List.

It will consist of about 40 pages 4to, in paper cover. Price, 5s.

Any Officer who may wish to subscribe for a copy, should send his name and address to

Major-General F. W. Stubbs,
Dromiskin House,
Castlebellingham,
Ireland.

The Inter-Regimental R.A. *v.* R.E. Racquet and Billiard Matches are fixed to be played this year at Chatham, on Friday and Saturday, the 8th and 9th of April. Any officer R.A. who may wish to be tried with a view to represent the Regiment in either event is requested to communicate with Captain A. J. Abdy, R.A., R.A. Institution, Woolwich.

The attention of all Captains and Subalterns is called to the new regulations for Gunnery and Long Courses detailed in R.O. No. 117, November and December, 1891.

Captain Lane's note-book for use of a Commanding Officer when ranging a Battery will be ready for issue during the current month.

The following are Noted as Worthy of the Attention of all Military Readers.

Magazines and Reviews.

1. "Military Criticism and Modern Tactics." III. By the author of "The Campaign of Fredericksburg." U.S. Magazine. October, 1891.
2. "The Effect of Smokeless Powder in the Wars of the Future." By Colonel Knollys. U.S. Magazine. October, 1891.
3. "The Progress of Modern Tactics." By Boguslawski. Translation. U.S. Magazine. December, 1891.
4. "The Conveyance of Troops by Sea." By Colonel Rothwell, R.A. I. and II. U.S. Magazine. November and December, 1891.
5. "Mounted Infantry Patrols, the Necessary Result of our Present System of Fighting." Major Carl Regenspursky. Journal of the R.U.S. Institution. December, 1891.
6. "A Light Cavalry Regiment on Active Service." By Captain F. Maude. Journal of the R.U.S. Institution. December, 1891.
7. "A Prussian Gunner's Adventure in 1815." By Captain May, R.A. U.S. Magazine. October, 1891.
8. "Our Military Weakness in India." I. and II. By C. B. Norman. U.S. Magazine. November and December, 1891.
9. "How to Re-organise the War Department." By General Sir G. Chesney. The 19th Century. December, 1891.
10. "Review of Major G. S. Clarke's Fortification." Edinburgh Review. October, 1891.
11. "Eight Weeks' Service in the German Army." Temple Bar. November, 1891.
12. "Smokeless Powders, their Composition and Manufacture." By Major C. H. Scott, R.A. Journal of U.S. Institution of India. October, 1891.

13. "The Future Rôle of the Army Reserve." By Major-General F. C. Trench, C.M.G. Blackwood. November, 1891.

Weeklies.

1. "The Great War of 1892." Commenced in "Black and White" 1st January, 1892.
2. "The Indian Cavalry Camp of Exercise." Army and Navy Gazette. January, 1892. Noting particularly that of 23rd January.
3. "Canet Q.F. Gun for Russian Government." The Engineer. 11th December, 1891.
4. "Nickel Steel Armour Trials." Engineering. 25th December, 1891.
5. "Canet *v.* Krupp Guns." Engineering. 25th December, 1891, 1st January, and 22nd January, 1892.
6. "War Material." Page 15, Engineer. 1st January, 1892.
7. "France and Quick-firing Guns." The Engineer. 8th January, 1892.

Books.

1. "Memoires du Genéral B^{on} de Marbot." Vol. I. Gênes—Austerlitz—Eylau. Vol. II. Madrid—Essling—Torres-Vedras. Vol. III. Polotsk—La Bérésina—Leipsig—Waterloo.

HALIFAX, N.S.

The 24th November, 1891, was the closing day of the "Cross Country Rides." They are our local substitute for hunting, and resemble a drag-hunt except that there are no drag and no hounds. They are, in fact, a kind of follow-my-leader on horseback, and afford very good fun to many persons, the field sometimes consisting of 30 horsemen and ladies, with numbers of people on wheels, and crowds of foot-folks. The season is the autumn and early winter, but it was brought to a close last year, not so much by the winter setting in as by the departure, on leave, of the leader and organiser of the "rides," Captain Jenkins, A.D.C., who, it will be remembered, was quartered at Woolwich, with the 2nd Battalion of the Rifle Brigade, in 1887. He deserves the greatest credit for the trouble he has taken in getting up these "rides," which entails obtaining the permission of owners to ride over their land, laying out the lines, removing wire, advertising the meets, etc. The country round Halifax is rough and cramped. The fences consist chiefly of stone dykes, and posts and rails, they are small, but quite big enough for the class of animal on which many people are mounted, though the leader himself always rode a thorough-bred English racer. Grief is not unknown, either: a well-known local sportsman came down the last day, and broke five ribs, and another day the General's niece's pony struck a rail with his fore-feet and turned completely over, nearly giving a bad fall to his fair rider, who, however, pluckily re-mounted and finished the run. The following of the R.A. took part in these "rides" during the season: Colonel Noyes, Major Waldron, Major McDonnell, Major Brady, Captain Alexander, Captain Boileau, Captain Yunge-Bateman, Lieut. Macgowan, Lieut. Stuart, Colonel Ryan's two sons and Miss Noyes. Captain Yunge-Bateman being the acknowledged "first-flighter."

A novel feature in sport, during a part of the months of November and December, was the importation, from a distant part of the Province, of a pack of cat-hounds, with their owner, a sturdy Nova Scotian hunter, called Jesse Bower. They were brought to Halifax by Lieut. Macgowan, and subscribed to by most of the officers of the garrison. The pack (?) is a wonderful one, for though it only consists of $1\frac{1}{2}$ couples it can hunt six days a week, and covers the country up to a radius of 25 miles. The hounds are fox-hounds. The hunting is on foot, through very thick woods, over very rough ground. The hunter carries a light rifle, and the etiquette of the "hunt" is that he hands the weapon to the first person in at the death, who shoots the cat, and thereby becomes the possessor of

the skin. It must not be supposed that these animals are domesticated cats turned wild; far from it, they are really not cats at all, but the *Barred Lynx* of British North America. They are large, wild, and fierce, and would kill the hounds if left alone. It is a fact that they kill lambs and poultry. Wonderful stories are told of what they will do if rendered savage by hunger, such as springing from trees upon people, and there is a tale of one having attacked a man while he was seated upon a wagon driving along the road. Be this as it may, old hunters declare, that if they were unarmed, they would rather not meet a wild cat alone in the woods. The so-called cat-hounds met 16 times, killed six cats and ran four to earth. The largest weighed 32 lbs. and measured 40 inches from snout to tail. It and another have now been mounted and set up in suitable cases, and are placed in the Mess Billiard-room, where they make excellent trophies. They have splendid skins. Their tails are very short and thick. There is a curious incident which should be related:—After one cat was killed the wire noose of a snare was found embedded in its neck, which it had probably been carrying about with it for years. When the animal was skinned that portion of the skin round the head and neck separated from the rest, just as if it had been cut with a knife.

This month Major McDonnell, Captain Yunge-Bateman and 2nd Lieut. Lyddon have been out moose hunting. They went separately, and at different times. The two former tried Cumberland County, but were unsuccessful, owing to want of snow. The latter tried Shelbourne County, where he bagged a fine young bull moose weighing about 600 lbs. 2nd Lieut. Lyddon, who has not been out before, is being congratulated on all sides on his good fortune.

The period which has elapsed since the last "Notes" were contributed has been marked by the departure of three officers, and, although two of them were not R.A. officers, the events may, nevertheless, be of regimental interest. Major Mansel, Rifle Brigade, has left us to retire from the service. He was well known to Gunners in India from 1882–6, as A.D.C. to Sir John Ross, at Poona. Out here he was military secretary to the same distinguished General. Major Mansel will be remembered at Halifax, for a long time, as the reviver of polo. Prior to his leaving he was entertained at the R.A. and R.E. Mess, at a dinner party of 35, to which all the polo players in the place were invited. Some amusing speeches followed, the burden of which was "polo."

Surgeon-General McDowell has also left us on retirement from the service. He is a C.B. and had seen a great deal of active service. He was a P.M.O. of the good old style, and will be very much missed, both officially and socially, especially the latter. Five years ago he was quartered at Woolwich, where his daughter was married to a Captain in the Regiment.

Captain and Mrs. Mullins left on 20th December. He has gone home to join the Long Course. We hope to see them both out here again in a year's time.

Lieut.-Colonel A. A. Saunders arrived on 22nd December from Plymouth, and has assumed command of the R.A. Halifax District. He is not accompanied by his family.

The following cutting from a Halifax local paper, dated 18th December, may be amusing, and is a fair sample of their style of serving up news:—

May Hear a Crack Band.

"The Royal Artillery band at Woolwich, it is likely, will be heard in Canada next year. The Admiralty and Horse Guards Gazette says: 'A pressing invitation has come to the Royal Artillery band to cross the Atlantic to perform on highly favourable terms a series of concerts at Montreal. The decision of the Commander-in-Chief is not as yet known but Cavalier Zavertal and his musicians have, we believe, accepted the offer. The Royal Artillery would be bereft of their orchestra for a period of six weeks in the autumn of 1892 should the necessary leave be granted.' This band is the strongest military band in England. If it

comes to Montreal, the R.A. officers on this station will very likely induce the organization to play in Halifax."

New Year's Day at Halifax this year was kept in the usual way. It was a general holiday for the troops in garrison. At 1 p.m. the Lieut.-Governor of Nova Scotia (Mr. Daly) held a *levée*, which was attended by all the military officers, in uniform; after that, those who felt inclined, attended the *levées*, held about the same time, by the Roman Catholic Archbishop of Halifax, the Church of England Bishop of Nova Scotia (represented this year by the Dean), and the American Consul. The officers of the R.A. and R.E. were "at home" in their Mess, from 1 p.m. to 7 p.m., and relays were told off to receive and entertain the incessant stream of callers, who numbered between 50 and 100. A table was spread in the ante-room, on which divers drinks, cigars, sandwiches, etc. were to be found, and on another table the Mess plate and some model guns were displayed. In private houses the old French-Canadian custom of New Year calling was carried out. The ladies remain at home (in local *parlance* "sit up"), while the gentlemen go round and call upon them. The gentlemen vie with each other as to the number of calls they pay in the day, 40 being considered a "record," while the ladies have a good deal of feeling about the number of visits they receive, these being carefully counted and recorded for comparison with their neighbour's score. It is said that a call paid on New Year's Day, in any town where this system prevails, is equal to half-a-dozen calls made at other times of the year.

This winter, up to date, has been the mildest experienced for many years. There has been no snow and, consequently, no sleighing nor tobogganning. People who have taken season tickets for the Skating Rink are regretting the step. The Curling Club is bankrupt, and its rink is in the hands of the sheriff's officers. This catastrophe, however, is due to want of funds, and not want of ice; nevertheless it is much regretted by those who prefer the "roaring game" to skating. There has been a little out-of-door skating, and on 2nd January the officers of the R.A. and R.E. took advantage of a cold "snap" to be "at home" on Williams' Lake, in the afternoon. The Mess establishment was sent out, and provided hot mulled claret, tea, and everything else considered necessary at an out-door winter party, while the R.A. "Musical Society" discoursed dance music, to which valses and lancers were danced on skates. And here one word about this "Society;" it is not orchestral nor a band, but merely some men with brass, reed, and other instruments, including a drum; in fact, to quote from an official letter on the subject, it is a "combination of musicians, playing together for their own amusement." To return to the skating party, which would have been a complete success but for an accident which befell Major McDonnell. For purposes only known to himself he seems to have left the cove where the party was being held and where the ice was perfectly safe, and skated along the edge of the lake where it was doubtful. All of a sudden he went through the ice and was plunged up to his neck in the water; his feet rested on the bottom, presumably on a large stone, for when he tried to reach the shore, which was only a few yards away, he found himself out of his depth. After floundering about for two or three minutes he was rescued by some hockey players, who formed a living chain, lying flat on the ice and holding on to each others heels; the leading file thrust out his hockey stick for the immersed officer to catch hold of, which he did, and by their combined strength was pulled out. He then made the best of his way home in his wet clothes, which was no joke, as it was a distance of three miles, including quarter-of-an-hour in a ferry boat. It is not supposed that Major McDonnell was in any actual danger of his life, nevertheless he was in a very unpleasant, not to say perilous, position. Those who know him best will not be surprised to hear that he never lost his equanimity during this untoward incident, and that the pipe, which he was smoking when the ice gave way, remained in his mouth all the time!

OBITUARY.

Major-General D. S. Greene, C.B., Colonel retired list, Royal Artillery, died on the 11th January, 1892. He joined the Army 1st May, 1846; became Captain, 17th February, 1854; Major, 24th March, 1858; Lieut.-Colonel, 10th November, 1868; Colonel, 10th November, 1873; and retired with the honorary rank of Major-General, 16th April, 1884. General Greene served in India as A.D.C. to Sir John Dupuis in 1857–58; commanded the Field Artillery at the action of Pandoo Nuddee, and also in several engagements on 27th and 28th November; was present at the operations round Cawnpore and its relief by Lord Clyde; present at the Battle of Cawnpore, 6th December, 1857 (four times mentioned in despatches, brevet of Major, medal, and C.B.); was selected by Lord Clyde to command one of the columns during the Fenian outbreak in Ireland.

Lieut.-Colonel A. B. Davies, Major retired list, Royal Artillery, died at 9, West Mall, Clifton. He joined the Army 1st November, 1860; became Captain, 24th November, 1874; Major, 1st July, 1881; and retired with the honorary rank of Lieut.-Colonel, 17th May, 1882.

Major-General J. W. Collington, retired list, Royal Artillery, died suddenly at College Villa, St. Helier's, Jersey, on the 11th January, 1892, aged 60 years. He joined the Royal Artillery 19th June, 1850; became Captain, 14th July, 1857; Major, 5th July, 1872; Lieut.-Colonel, 21st August, 1875; Colonel, 21st August, 1880; and retired with the honorary rank of Major-General, 18th April, 1882.

Major-General E. W. S. Scott, retired on full pay, late Royal (Bengal) Artillery, whose death occurred at Cambridge on 1st January, 1892; joined the Bengal Artillery 12th December, 1828. He served in the suppression of the Indian Mutiny in 1857–8, including the battles of the Hindun on the 30th and 31st May, 1857, siege of Delhi, and operations of Brigadier Showers' column (mentioned in despatches, brevet of Lieut.-Colonel, medal with clasp).

Major-General Henry Francis, retired on full pay, late Royal (Bengal) Artillery, died at Sandgate, Kent, on 24th January, 1892. He joined the Bengal Artillery 8th January, 1842, and retired with the honorary rank of Major-General, 31st December, 1878. He served in the Sutlej Campaign of 1849, including the Battle of Sobraon (medal), Punjab Campaign of 1848–49, including first and second siege operations before Mooltan; action of Soorajkoond and Battle of Goojerat (mentioned in despatch, medal, with two clasps). Fourth Class of the Medjidie for service with the Turkish Contingent. Served at the Alumbagh in February, 1858; at the siege and fall of Lucknow, Rohilcund Campaign, with the affair of Roveah and capture of Bareilly (medal with clasp, and brevet of Major).

Major-General G. G. Brown, retired on full pay, late Royal (Bombay) Artillery, died at Clifton, 26th November, 1891. He entered the Bombay Artillery, 7th June, 1844, and retired with the honorary rank of Major-General, 31st December, 1878. He served in the suppression of the Indian Mutiny, including the siege and capture of Awah, siege and capture, by assault, of Kotah (mentioned in despatches), and action of Somgoneer (mentioned in despatches, brevet of Major, medal with clasp).

Lieutenant Ernest H. Davis, Royal Horse Artillery, whose death occurred at Rawal Pindi, on 20th December, 1891, joined the Regiment 29th April, 1885.

DIARY OF FIXTURES.

FEBRUARY.

Days of the Mth.	Week	
1	M	Long Course Officers and N.-C. Officers Garrison Artillery begins.
2	T	. . . . .
3	W	. . . . .
4	Th	. . . . .
5	F	. . . . .
6	S	. . . . .
7	S	. . . . .
8	M	. . . . .
9	T	. . . . .
10	W	. . . . .
11	Th	. . . . .
12	F	Kempton Park Meeting (2 days) begins.
13	S	. . . . .
14	S	. . . . .
15	M	. . . . .
16	T	Sandown Park First Spring Meeting (2 days) begins.
17	W	R.A. Band Concert at Woolwich at 3 p.m.
18	Th	. . . . .
19	F	. . . . .
20	S	. . . . .
21	S	. . . . .
22	M	. . . . .
23	T	. . . . .
24	W	R.A. Band Concert at Woolwich at 3 p.m.
25	Th	. . . . .
26	F	R.A. Band Concert at St. James's Hall at 3 p.m.
27	S	. . . . .
28	S	. . . . .
29	M	. . . . .

MARCH.

1	T	. . . . .
2	W	Ash Wednesday. R.A. Band Concert at Woolwich at 9 p.m. Sacred Music.
3	Th	. . . . .
4	F	Sandown Park March Meeting (2 days) begins.
5	S	. . . . .
6	S	. . . . .
7	M	. . . . .
8	T	. . . . .
9	W	R.A. Band Concert at Woolwich at 3 p.m.
10	Th	. . . . .
11	F	Grand Military Meeting Sandown Park (2 days) begins.
12	S	. . . . .
13	S	. . . . .

Days of the Mth.	Week	MARCH—*Continued.*
14	M	. . . . .
15	T	. . . . .
16	W	R.A. Band Concert at Woolwich at 9 p.m.
17	Th	. . . . .
18	F	. . . . .
19	S	. . . . .
20	S	. . . . .
21	M	Lincoln Spring Meeting begins.
22	T	. . . . .
23	W	R.A. Band Concert at Woolwich at 3 p.m.
24	Th	Liverpool Spring Meeting begins.
25	F	Grand National.
26	S	. . . . .
27	S	. . . . .
28	M	. . . . .
29	T	. . . . .
30	W	R.A. Band Concert at Woolwich at 3 p.m.
31	Th	. . . . .
		APRIL.
1	F	. . . . .
2	S	. . . . .
3	S	. . . . .
4	M	Senior Class Officers begins. Firemasters' Class Officers begins.
5	T	Epsom Spring Meeting begins.
6	W	R.A. Band Concert at 9 p.m. City and Suburban.
7	Th	Sandown Park begins.
8	F	R.A. *v.* R.E. Inter-Regimental Racquet and Billiard Matches at Chatham. 1st day.
9	S	R.A. *v.* R.E. Inter-Regimental Racquet and Billiard Matches at Chatham. 2nd day.
10	S	. . . . .
11	M	. . . . .
12	T	. . . . .
13	W	R.A. Band Concert at 3 p.m.
14	Th	. . . . .
15	F	Good Friday.
16	S	. . . . .
17	S	Easter Sunday.
18	M	Bank Holiday.
19	T	Newmarket Craven Meeting begins.
20	W	R.A. Band Concert at St. James's Hall at 3 p.m.
21	Th	. . . . .
22	F	. . . . .
23	S	. . . . .
24	S	. . . . .
25	M	. . . . .
26	T	. . . . .
27	W	. . . . .
28	Th	. . . . .
29	F	Long Course leaves Woolwich.
30	S	. . . . .

PRÉCIS
AND
TRANSLATIONS.

"REVUE MILITAIRE DE L'ETRANGER."

APRIL, 1891.

"THE EMPLOYMENT OF PLUNGING FIRE IN THE FIELD."

TRANSLATED BY
LIEUT.-COLONEL J. H. G. BROWNE, LATE R.A.

INTRODUCTION.

In publishing this translation the Committee would call the attention of readers to a *précis* translation, by Major E. S. May, R.A., of a series of articles from the *Militär Wochenblatt*, published in No. 5, Vol. XVIII., R.A.I. "Proceedings," December, 1890.

The following translation is interesting as giving a French refutation of the views held by a distinguished Bavarian artillerist, who has perhaps been rather led away by his enthusiasm for high-angle artillery fire in the field.

In the conferences upon "Sudden Attacks against Fortified Places," of which the *Revue Militaire de l'Etranger* gave an analysis in 1889,[1] General von Sauer promulgated the opinion that with the perfected means which are now at the disposal of the artillery it is possible to reduce a fortified place in a few days. These "perfected means" consist in shrapnel fire and in plunging fire. "With these means," says the General, "siege warfare need no longer be carried on according to special rules; the procedure laid down in the Infantry Regulations for the attack of a strongly entrenched position are sufficient." In justification of this assertion, the General relies upon two principal reasons—(1.) That the line of detached forts of a large fortified place is very difficult to defend on account of its extent, and of the wide intervals which separate the works from each other; these intervals forming weak zones, only slightly commanded by the forts, and easily forced by the assailants. (2.) That the moral and material position of the defenders is very inferior to that of the assailants, and that consequently they have not the same opportunities of taking advantage of the new means of warfare now possessed by the artillery.

We find similar ideas expressed in a very remarkable paper, read last year by General von Sauer before the officers of the garrison of Ingoldstadt, which we are about to review. But on this occasion, leaving siege warfare on one side, the author considers the case of a battle in the open field, and supposes that one of the adversaries occupies a position, for the defence of which he has called in aid all the resources of temporary fortification. His object is to prove that in spite

[1] See "Proceedings" of the R.A. Institution, No. 11, Vol. XVII.

of all the advantages which the defenders may derive from a repeating rifle with smokeless powder, the assailants may easily drive out their adversaries if they make extensive use of the plunging fire of shrapnel shell.

To prove his statement, General von Sauer begins by remarking that direct fire has two serious inconveniences. First, the small angle of descent of the projectiles, which prevents troops, sheltered even by a low parapet, from being struck; secondly, the low angle of elevation, which prevents the piece from being fired "from a position concealed from the view of the enemy."

It may be remarked at once that these statements are too sweeping; certain restrictions must be made, which are important, and on which something should be said. For instance, with regard to the angles of descent, it is well known that at long ranges they are so considerable that the projectiles can strike a target placed behind a parapet. Thus, at 5000 metres the shell of the 9^{c} German field gun has an angle of descent of 31°. At 3500 metres the angle of descent of the 9^{c} shrapnel is 16°, and, the angle of the cone of dispersion being from 20° to 22°, it follows that the bullets placed at the lower part of this cone will strike the ground at an angle of 26° to 27°. It is only at medium and short ranges that plunging fire has in this respect a real superiority over direct; and even when a target cannot be reached by direct frontal fire, it can often be struck by oblique fire without having recourse to plunging fire.

Again, with regard to firing from behind a covering mass, indirect field firing may be carried on under these very conditions. It is true that the pieces must be withdrawn some distance from the covering crest to enable the projectiles to pass over it, so that the protection is only relative; but they are completely covered from the view of the enemy, which is very important, especially when smokeless powder is used. The existence of a covering mass in front of the guns is a serious difficulty in the regulation of the enemy's fire. As an artillery officer, General von Sauer cannot be ignorant of this truth. The minimum distance which must exist between the pieces and the covering crest in the case of direct and indirect fire depends upon the height of this crest above the horizontal plane passing through the axis of the trunnions, and upon the angle of elevation of fire. It may be useful to give some statistics for purposes of comparison.

We have assumed the case of a German 9^{c} Field Battery placed behind a covering mass of three metres in height, such as a railway embankment, and firing shrapnel shell. The following table gives, for every 500 yards of range, the minimum distance at which the battery must be placed behind the covering crest in order to carry on its fire:—

Range.	Elevation.	Distance between the Battery and the covering crest.
[1]1000^{m} = 1083^{yds}	1° 4′	80^{m} = 87^{yds}
1500 = 1625	3° 4′	44 = 48
2000 = 2167	4° 34′	29 = 31
2500 = 2708	6° 22′	21 = 23
3000 = 3250	8° 19′	16 = 17
3500 = 3792	10° 34′	13 = 14

These distances, it will be seen, are not excessive; and the Battery Commander might easily place himself near the covering crest so as to see the target, and direct the fire of his guns in person. A battery for high-angle fire, with higher angles of elevation, can, of course, if the ground permits, be placed closer to the covering mass, but it will be seen presently that this advantage is often illusory in the field.

[1] A French metre being equal to 39 inches very nearly.—*J.H.G.B.*

Again, General von Sauer finds fault with the present field guns for not being adapted for firing shrapnel with a wide cone of dispersion, the only method in his opinion of reaping the full advantage of plunging fire. His arguments in support of this theory may be summed up as follows :—Hollow projectiles, like common and shrapnel shell, only produce effect by bursting; but this effect is very different in the case of direct and of high-angle fire. For instance, in the case of a shrapnel fired directly and reaching the target with a "remaining velocity" of 300 or 400 f.s., it is evident that the velocity of the splinters and bullets will principally depend upon that of the projectile at the moment of bursting. In this case we obtain an action powerful as to length, but weak as to depth; that is to say, a very long, but very narrow, cone of dispersion. To strike an object sheltered behind a parapet with pieces with flat trajectory, it is obvious that the cone of dispersion must be widened. This result can only be obtained by using an explosive *(explosif)* so powerful as to give the bullets a velocity very superior to that possessed by the projectile at the moment of bursting. But this cannot be done in the case of the present field guns, where the "remaining velocity" is great and the bursting charge is small.

The conditions are very different with pieces intended for high-angle fire, mortars or howitzers. In this case the remaining velocities are low, the interior charge is large, and there is, therefore, no difficulty in giving the bullets a velocity very superior to that of the remaining velocity of the shrapnel by the employment of a "breaking" charge (*charge brisante*). A shrapnel loaded in this manner and bursting at a good height above the ground will not produce any great effect in depth, but its action will be felt on all sides, and will be terrible. The object aimed at will be covered with a regular hail of bullets descending almost vertically, and if the troops, decimated by this murderous fire, try to take refuge in their shelters they will be none the less in danger, for "a plunging shell with its 'breaking' charge (*charge brisante*) can penetrate every kind of cover which can be made use of in the field."

If then this reasoning is correct, the employment of plunging fire upon the field of battle will necessarily entail the abandonment of the shrapnel with the narrow cone of dispersion, and the adoption of that with the wide one. But we may be allowed to dispute this opinion, and to inquire whether there is any necessity for resuscitating a projectile, which has long since been abandoned by the artillery.

General von Sauer takes exception to the shrapnel with the narrow cone of dispersion because it only acts in one direction, that of depth. This mode of action, which appears to him suitable for direct fire, is not so for plunging fire, because, he says, in the case of marks behind cover, "a terrible effect must be produced in every direction, and a hail of bullets must fall upon the mark such as is only possible by the use of the shrapnel with the open cone of dispersion."

To show the inaccuracy of this conclusion it need only be pointed out that when it is wished to cover a mark with a "hail of bullets" there is little sense in using a projectile which disperses splinters and bullets in all directions. The fact is that the artillery have preferred the shrapnel with the narrow cone of dispersion in order to retain the possibility of producing a powerful effect, even if the projectile bursts at a considerable distance in front of the target. The trajectories of the individual bullets being nearly parallel, the cone of dispersion is very long; and although, in spite of every care taken in the manufacture of fuzes, the position of the bursting point may vary within considerable limits, nevertheless the target is struck with good effect. This advantage is as important for direct as for plunging fire. This fact has been clearly demonstrated in the numerous experiments made by the Russian artillery in field shrapnel fire. Without entering into a deep discussion upon this question, it may be said that the effect produced by the shrapnel with the open cone of dispersion is always

more uncertain than that produced by the other, because as the bursting interval increases the number of hits upon a given target decreases more rapidly in the first case than in the second. The shrapnel with the open cone of dispersion requires great exactness of fire, and this exactness is difficult to obtain in the case of plunging fire, because experience has shown that, on account of the low velocity of the projectiles, any error in the burning of the fuzes is more important than it is in the case of direct fire. General von Sauer does not seem to have considered this established fact.

There still remains the consideration of the nature of the piece, mortar or howitzer, and its calibre. The General does not give any definite opinion upon this question. He leaves it to the future to determine. But, with regard to calibres, it appears to him that the choice lies between 12 c and 15 c.

" If it is thought," he says, " that the enemy, even when in the field, must be crushed in and with his works of shelter, and if it is thought that the resistance of these works is equal to that of permanent or provisional ones, then the highest calibre must be approached to as nearly as possible; but if on the contrary it is thought sufficient to strike the enemy when in the open; if the resistance of field works is lightly esteemed; if, lastly, it is thought that firing at invisible works is only a waste of time and ammunition, then the smaller calibres should be used. These are questions which experience only can determine, and the solution will come of itself when the weight of projectile corresponding to the end in view has been once fixed upon."

Here, again, it would have been easy to lay down more precise conclusions. It seems as if to propose the question were to answer it, and that the small calibre should be preferred for the following reasons. In the first place, the reduction in size of the calibre permits the use of a lighter and therefore more portable weapon; secondly, the projectiles weigh less, and consequently a larger supply can be carried with the pieces. Besides, with regard to the resistance of field works, it is certainly very seldom that such resistance can equal that of permanent works, whose thick arches of concrete can resist the fire even of mortars of large calibre.

After these technical considerations, General von Sauer begins another part of his subject, and tries to show that, with regard to laying the pieces, a battery of mortars or howitzers possesses undoubted advantages over one intended for direct fire.

" Technical considerations," he says, " have less influence upon the tactics of combat than the difference which exists between direct and plunging fire. For instance, let us suppose a battery of mortars placed behind a wood or an elevated crest; in this position it is entirely invisible to the enemy, especially with smokeless powder, but cannot judge of the effect produced by its fire. The regulation of fire must be carried on from a point from whence the target can be well seen, and it is clear that a system of signals must be established to communicate the results of the fire as observed from the post of observation. The first direction will be given to the pieces by means of the compass, and, as the time of flight in the case of plunging fire may run up to 15 or even 30 seconds, it is evident that the regulation of fire cannot be as rapid as in the case of a battery firing directly; nevertheless the rate of fire may be considerable as soon as the correct range has been determined. This last operation is very much facilitated by the great cloud of smoke made by the bursting of the projectile, by the high angle of descent, by the low velocity, and above all by the well-defined lines of the enemy's works of defence."

We have faithfully reproduced the opinions of the Bavarian General, and, on reading the preceding lines, we cannot but be surprised at his taking as an example a kind of fire which is, and can only be, an exception. In theory there is no objection to be raised. A battery takes up a position behind a wood, finds

direction in the first place with the compass, and regulates its fire by means of lateral observers, who communicate with it by a system of pre-arranged signals. This is simple enough, and it seems as if nothing would prevent the fire from being carried on under these conditions. But in reality matters will not arrange themselves as easily as one thinks, and General von Sauer must know that a battery would have great difficulty in regulating and conducting its fire under such circumstances. He forgets that we are now dealing with a field of battle and not with a fortified place. In a siege the battery would no doubt attain its object by means of patience and with a great expense of projectiles; but in the field, where time is precious, where operations must be quick, and where ammunition must be economised, such a course is inadmissible. The employment of the compass to give the first direction to the pieces entails loss of time, and sometimes even considerable errors; also communications by signal are always slow, require a practised staff, and are never as good as direct observation.

The General's ideas are all the less acceptable in that he is here dealing with the attack. If we suppose an attacking battery to place itself voluntarily behind a wood or elevated crest, which masks the object aimed at so completely that for observations of the fire he is obliged to trust to observers placed, perhaps, several hundred metres from him, it is evident that his position will be full of inconveniences, if not of dangers. It does not follow that high-angle fire is impossible in the field, but, in order that it may be practicable, it is necessary that the commander should see the target himself, still keeping near enough to the battery to regulate its fire and superintend its detachments in person.

The objections just made against laying by the compass have already been stated in the *Militär Wochenblatt* of 7th June, 1890, which proves that von Sauer's theories have not been universally accepted in Germany.

"The method of laying pieces by the compass," says the correspondent of the *Militär Wochenblatt*, "and the employment of signals, by which General von Sauer hopes to regulate the fire, hardly appear practicable on the field of battle owing to the loss of time and the grave inconveniences which they entail. These methods are always applicable to guns as well as to howitzers; the only real difference being that the first are obliged to keep some distance from the covering mass, while the second can come quite close. On the field of battle everything should be as simple as possible, and therefore care should be taken, even with howitzers, not to take up a position from which the target cannot be clearly seen, either from behind the guns or from the top of the limbers. Moreover, even in the case of field guns, it will be possible to find positions from which fire can be perfectly well carried on, while defiladed from the view of the enemy."

General von Sauer, in his reply, confines himself to generalities, without indicating the practical method of applying this system which he recommends.

With regard to regulation of fire, the General admits that the operation is more difficult in the case of high-angle than of direct fire. This fact constitutes an inferiority in the first-named to which attention must be drawn. In these days, in the artillery combat, whichever of the two combatants first succeeds in finding the range has the greater chance of obtaining a superiority in fire. Now the time of flight of the projectile has an important influence on the time required for finding the range, because the Battery Commander, in order to regulate the fire of a piece, has to wait until the projectile of the preceding piece has burst. General von Sauer, indeed, alleges that this disadvantage will be compensated for by the greater facilities which batteries for high-angle fire will have for finding the range. But even admitting this, and admitting also that the great cloud of smoke produced by the bursting of the shrapnel, the high angles of descent, the low velocities, and above all the prominence of the enemy's positions facilitate the observation of fire, we do not believe that these advantages will be sufficient to enable the attacking batteries, in the peculiar position they are in, behind a

wood which masks the battle-field, to obtain a rapid superiority over the enemy. But besides this, some of the advantages which the General claims for the attack seem to be very problematical. Granted that the shrapnel for plunging fire, being of larger calibre than that for direct fire, produces a greater cloud of smoke in bursting, thus rendering observation more clear and easy; granting again that the enemy's positions will be very visible, which renders them liable to be struck with greater certainty; still it does not seem evident why the "high angles of descent" and the "low velocities" offer special advantages to the assailants. Some observations on this point would not have been superfluous.

It has just been seen that General von Sauer makes the same objection to field fortifications which he does to permanent, viz.:—that of being too visible. "Field works," he says, "are clearly distinguished from the surrounding ground by their slopes of freshly thrown up earth, and there is seldom sufficient time to mask them. Now nothing is more favourable for finding the range than the existence of a very visible parapet, and nothing will demoralise the men placed behind this parapet more than a feeling of the uselessness, or even of the danger, of the shelter thrown up at so great expense. These parapets have little to fear from direct fire as long as they are not taken obliquely or in reverse, but with plunging fire the conditions are very different."

Long ago General von Sauer maintained that permanent works offered a favourable mark for siege guns from their conspicuous outlines, and he now asserts the same of temporary fortifications. This statement is certainly too sweeping. We cannot but think that with smokeless powder the defender will be able to conceal the position of his works better than formerly if they only make a reasonable use of natural cover and of the resources of field fortification. Indeed, if the defence is conducted with any sort of ability, the reconnaissance of the positions will be very difficult for the attack, and will probably take more time than formerly, because there will be no smoke to give valuable indications.

With regard to the statement that the defence has little to fear from direct fire, unless its parapets are taken obliquely or in reverse, this is not true since the introduction of torpedo shells into the equipment of Field Artillery. These shells will destroy earthen parapets without having recourse to plunging fire, and thus expose the men behind them to shrapnel fire.

Again General von Sauer is so convinced of the superiority of plunging fire, that he even claims that it will be more efficacious than direct fire against the borders of woods and boundaries of villages. We do not know upon what experiences this opinion is based, but it is contrary to the German Infantry Regulations on the duties of pioneers in the field, which recommend that the defenders should be placed from 100 to 200 metres in front of the boundary of the wood or village "in order to withdraw themselves as much as possible from the destructive effects of artillery fire."

Convinced of the excellence of the arguments which he has produced to prove the insufficiency of direct fire, General von Sauer concludes from them that the assailant ought to make a very extensive use of high-angle fire. He maintains that direct fire cannot drive the enemy from his position or shake him sufficiently to enable the attacking columns to carry the lines without heavy loss, as he will be in comparative safety either in shelters in rear of the works or when seated at the foot of the interior slope, whereas high-angle fire can render both the parapets and shelters untenable.

It is quite true that direct fire produces little effect against troops seated at the foot of the interior slope, but as soon as the men stand up to fire circumstances are quite altered. It will, of course, be said that the tactics of the defenders is to reverse their fire until the enemy's artillery is obliged to cease firing so as to avoid hitting the troops, which have approached within 200 or 300 metres of the works. But this is a difficult moment to seize, and frequent errors

may be apprehended. If the defenders begin to fire too soon the attacking batteries may re-open and inflict unexpected losses; if they begin too late they run the risk of not being able to check the assault. This is a real danger, and absolutely independent of the employment of plunging fire.

It is evident, however, that—in default of torpedo shells—it is necessary either to increase the angle of descent of the projectiles or the extent of the cone of dispersion, in order to strike men who are under cover of the interior slope. But granting that one of these two solutions has been adopted, the defenders will still have a very simple means of escaping from the artillery fire. This means, which is recommended by the German and Austrian Regulations, consists in not occupying the works at the beginning of the combat, but in keeping the troops outside in rear or on the flanks, either in artificial shelters or behind natural cover of some kind, only leaving some sentries in the work itself. The parapets will not be manned until the enemy's infantry has approached near enough to encourage the hope of inflicting serious losses upon it by musketry fire. In this way the defenders will avoid exposing themselves prematurely to the artillery fire, and it is questionable whether under these circumstances plunging fire could produce an appreciable moral effect before the assault. The outside shelters, placed behind the works and masked from view, can hardly be reached without an inadmissible expense of projectiles, which can with difficulty be replaced on the field of battle.

According to General von Sauer, one of the greatest advantages possessed by high-angle fire is that it can be employed to accompany the assault up to the last moment. In the case of guns with a low trajectory, the angles of descent are small, and firing over the heads of infantry is dangerous as soon as the assaulting troops are near the point of attack.

It seems at first sight that a similar danger does not exist with high-angle fire; but it is not so. The General's opinion would hold good if percussion fuzes were employed, but with time fuzes, and especially with wide cones of dispersion, the advantage of high angles of descent is partly annulled by serious inconveniences. It must be remembered that, with the low velocities of plunging fire, any error in the burning of the fuzes will produce considerable effect, and if the shrapnel bursts too high the cone of dispersion will cover a large extent of ground and the bullets may strike friendly troops.

General von Sauer takes no account of this fact. He believes that ordnance used for high-angle fire will be very useful in supporting the assaults, because they are not obliged to cease firing and to change position in order to follow the infantry in their advance. They will also support the ordinary Field Artillery during their changes of position. "We may believe," he says, "that the support of high-angle fire will be necessary to enable Field Artillery to change position when required. If the defence has deployed a sufficient number of guns to prevent such a change of position, will not the attack remember with pleasure the *diabolical force* which it possesses in its mortars and howitzers?" With such support they will overcome all resistance.

The General seems to forget that both sides equally will make use of mortars and howitzers. The final success will rest, as it always does, with the more skilful; but it may be claimed that the defence has over the attack the advantage of better known ranges, and is, in that respect, better prepared for the contest. The General does not, however, seem to think so, for he is of opinion that, if the attack appreciates all the values of curved fire, he will not care much for the defenders' guns, because some batteries for plunging fire will be able to tactically destroy even a superior force of artillery using direct fire only. For the latter must post themselves so that nothing can interfere either with their field of fire or that of sight, and therefore must expose themselves; while the former need not expose themselves at all, and can only be struck by high-angle

fire. These conditions would, of course, change if the batteries for plunging fire were to expose themselves to the direct fire of the defence, but they have no object in doing so. It makes no difference to them whether they are placed directly in front or obliquely, a little higher or a little lower. They will have free choice in selecting their positions and will be completely covered from direct fire.

Here again we find the author's usual method of discussion, a method which consists in granting everything to the attack and nothing to the defence. Besides, in writing thus, the General evidently loses sight of the field of battle, and thinks only of siege warfare. He is thinking of artillery, placed without overhead cover upon the ramparts of a fort, which is undoubtedly very much exposed to the plunging fire of siege batteries. Now that which gives the superiority to pieces using high-angle fire and renders them almost invulnerable, is that they are placed quite close to the covering mass, and that, therefore, very high angles of descent are necessary in order to strike them. But on the battle-field the attack will seldom be able to place their batteries under such favourable conditions, because they can only utilise such cover from ground as they can find. It will often happen that guns will be obliged to keep at a considerable distance from the covering crest, so that the protection which they receive from it will be seriously diminished. One example will be sufficient to prove this fact. At 2500 metres the 9^{c} German field shrapnel has an angle of descent of about 9°, and the angle of the cone of dispersion being about 20°, the lower part of this cone will strike the ground at an angle of about 19°. Now, if we imagine a battery placed behind a covering mass of six feet in height, such as a railway embankment, and played upon by 9^{c} guns laid upon the crest of the covering mass, a very simple calculation shows that, in order that the battery should be struck, it is only necessary that it should be withdrawn 18 metres from the covering crest. All the ground beyond this 18 metres is swept by the bullets as if the covering mass did not exist. On the field of battle will not the artillery often be obliged, in consequence of the nature of the ground, to take up a position even less defiladed than the above? Indeed, it is probable that the cases will be very rare when batteries for plunging fire will be able to approach sufficiently near to the covering mass to be in as favourable a position as guns mounted upon the terreplein of a siege battery. They will generally be less protected, and consequently less invulnerable, than General von Sauer would like to think.

The *Militär Wochenblatt* agrees with this opinion. "We cannot admit," it says, "that howitzers possess any advantage over guns for the artillery duel; we even go further, and opine that the introduction of smokeless powder and the increase in the intensity of infantry fire, which will lead to the most complete utilisation of all natural cover, further increase the advantage of the guns. This may seem paradoxical, but it must not be forgotten that when we speak of utilising natural cover we mean not absolute defilade from fire, but defilade (more or less complete) from view, so as to render the regulation of the enemy's fire very difficult. With a shrapnel like ours (the German), whose dangerous zone is very deep, it is not necessary to fix the range with great accuracy, as this projectile gives results when it bursts 100, 150, or even 200 metres short of the target. It is therefore possible, when the regulation of fire is difficult, to include the target between two extreme limits, and then between these limits to rake the ground by successively raising or lowering the elevation. On the other hand, the dangerous zone of howitzers is so small that the range must be accurately determined in order that they may produce the same effect as guns. It is impossible to obtain this accuracy when observation is difficult, and the regulation of fire always takes time; whereas on a battle-field it is much more important to arrive rapidly at a moderate result than to attain brilliant effects after a delay more or less long."

The last advantage which General von Sauer claims for batteries using plunging fire seems open to dispute. He says :—" When the plunging-fire batteries have ceased firing for fear of striking the infantry which have advanced to within 200 or 300 metres of the point of attack, if subsequently these troops begin to retire there is no reason why fire should not be resumed to check the enemy's pursuit as soon as circumstances permit. Such a support could only be given by plunging fire."

It does not appear upon what grounds he bases this last assertion, which is in direct contradiction to the German Artillery Regulations, in which we read :— " If the infantry attack fail, the batteries, and especially those most advanced, should support the infantry in their retreat and check the enemy's pursuit."

It may be added that batteries firing directly have the advantage over batteries using curved fire of being able to change their target more rapidly, as it is well-known that the operation of finding a new range generally takes longer in the case of high-angle fire than in that of direct fire.

Again, our author thinks that the remarkable properties of high-angle fire entail a very large employment of mortars or howitzers upon the field of battle. " It is a mistake," he says, " to consider these pieces simply as a reserve capable of being employed only in certain special cases, such as the moment of assault, in order to give the defenders their *coup de grace*."

All the Powers which have introduced mortars into their field armament, such as Austria and Russia, have a very limited number of these pieces. As yet Russia has only three regiments of mortars of four batteries each, or 12 batteries only for the whole army. This proportion seems much too small for General von Sauer, who attaches such importance to these new pieces that he wants a battery for high-angle fire to each infantry brigade, or four for an Army Corps. " This number is necessary," he says, " in order that the batteries may come into line and make their powerful action felt from the beginning."

They will support the deployment of the batteries for direct fire, which in their turn will prepare for the infantry attack, and they will continue their action up to the moment of the decisive attack, and then produce their utmost effect. Such, in a few words, are the tactics recommended by the author.

But even admitting that these new batteries will be more strongly represented in the armies of the future, it hardly follows that they will bring a greater element of strength to the attack than to the defence. If both sides are provided with mortars and howitzers, they will be in the same relative position that they were before. If the effect of these pieces is as great as is represented, it is evident that the high-angle firing pieces on the one side will try to destroy those on the other, and the duel which will result will constitute a new phase in the combat. But there seems to be no reason why one side should have the advantage over the other, and nothing appears to justify the introduction of a new equipment, less portable than the ordinary one, necessitating heavier and, therefore, fewer rounds of ammunition, and always entailing a very serious complication in the supplies. With all due respect to General von Sauer, the opinion expressed some time ago by the *Jahrbücher für die deutsche Armee und Marine* appears much wiser, according to which " Pieces for high-angle fire should only be used to arm special batteries, maintained in addition to the organised units of the mobilised army. These special batteries will take but little part in the ordinary work of the artillery, but will be principally intended to direct a crushing fire upon the point of attack immediately before the assault. They will not, therefore, open fire at the very beginning of the action, but as soon as the course of events has developed the character of the combat." In short, they will give the enemy his *coup de grace*.

The *Jahrbücher* think that the proportion of one battery for high-angle fire to each Army Corps would be quite sufficient to meet all requirements. This pro-

portion seems more suitable than that of the General, who, in asking for four batteries per Army Corps, is evidently looking at the conditions of siege warfare. The General thinks that a field army should be just as capable of attacking a fortified place as of storming a position in the open field. It should, therefore, possess the means of overcoming the defenders, whether the latter shelter themselves behind permanent works or behind temporary ones. In his essay upon "Sudden Attacks Against Fortified Places," General von Sauer has already tried to prove that permanent works cannot resist high-angle fire. It remained to prove that this kind of fire would find its natural and necessary employment upon the field of battle; hence the essay which we are now discussing.

As has been already remarked, this theory, however ably expressed, is much too absolute. We need not here go back to the "Sudden Attacks Against Fortified Places," it is sufficient to refer to the articles which have appeared in the *Revue Militaire de l'Etranger* to show how exaggerated General von Sauer's ideas on this subject are. The new theory which he now propounds is also open to grave discussion, and it is difficult to admit that a field of battle can in all points be likened to a fortress. The author's arguments do not appear sufficiently strong to be accepted without dispute. No doubt unity in tactics would be very desirable, if it were possible. But would not the danger arise, that in giving to Army Corps a large number of batteries for high-angle fire with the view of enabling them to carry out a sudden attack, they would be over-weighted, would be rendered more suitable for the defence than for the attack, in short, would lose the mobility which is so necessary for offensive operations?

We will now recapitulate the principal arguments employed against General von Sauer's theories with regard to the extensive employment of plunging fire upon the field of battle.

1.—It is not correct to say that the defence upon the field of battle always presents conspicuous targets to the attack. If the defence knows how to make a judicious use of natural cover and of temporary fortification, it will conceal from the enemy the organisation of its lines and the distribution of its forces. With smokeless powder the reconnaissance of a defensive position will be very difficult.

2.—Plunging fire, in spite of the progress made of late years, will be sparingly employed in the field, because its regulation takes a long time in consequence of the lengthened time of flight of the projectiles. Also it does not possess any special advantages with regard to range, its effects are, so to speak, localised, and this inconvenience is not corrected by the employment of a shrapnel with a very wide cone of dispersion, as General von Sauer pretends. Again, this kind of fire is with difficulty adapted to rapid changes of the object aimed at; a fact which renders howitzers, and especially mortars, powerless to repel surprises. Lastly, in consequence of the weight of their projectiles, these pieces can never be supplied with more than a small number of rounds, which is a serious inconvenience, especially for the attack.

3.—It is not correct to say that the assailant's mortars or howitzers will be always invulnerable to the direct fire of the defence, because in the open country sufficient cover will seldom be found to insure complete defilade. In this respect the defence has the advantage over the attack, having usually plenty of time at disposal to select the most favourable positions for its plunging batteries.

From these reasons it may be concluded that the employment of plunging fire in the field will always be of a limited character, but that it will intervene, more by its moral effect than by its real action, upon certain points of the battle-field. The proportion of a battery to each brigade, recommended by General von Sauer, is therefore much too large; it would result is over-loading the Army Corps without any sufficient compensation.

NOTES

FROM

CORRESPONDING MEMBERS.

ANY member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

THE Records of the Royal Military Academy are about to be re-published in the original form, with additions and drawings, bringing it up to date; the estimated cost will not exceed 12s. 6d. a copy.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

A NEW "Kane's List" having been recently published, and progress having been made in collating relationships of R.A. Officers past and present, Officers are requested to notify to the Secretary, R.A.I., any relationship existing between them and any other officer of the same name registered in "Kane's List."

THE subject for the Duncan Gold Medal Prize Essay, 1892, is: "Fire discipline; its necessity in a Battery of Horse or Field Artillery, and the best means of securing it.

Attention is called to the Rules for Prize Essays, &c., and Officers are asked to be careful in posting their essay intended for competition in time to reach the Secretary before the 1st of April.

COPIES of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

THE Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

THE Catalogue of Works (Authors' Index) added to the Library from 1882 to present date, is taking longer in the press than was expected, but the application of any member wanting a copy will be noted, the copy sent within a few weeks.

MAJOR-GENERAL F. W. Stubbs, Retired list, Royal (late Bengal) Artillery, is compiling a List of Officers who have served in the Regiment of Bengal Artillery from its first formation down to its absorption into the Imperial List.

It will consist of about 40 pages 4to, in paper cover. Price, 5s.

Any Officer who may wish to subscribe for a copy, should send his name and address to

Major-General F. W. Stubbs,
Dromiskin House,
Castlebellingham,
Ireland.

The Inter-Regimental R.A. *v.* R.E. Racquet and Billiard Matches are fixed to be played this year at Chatham, on Friday and Saturday, the 8th and 9th of April. Any officer R.A. who may wish to be tried with a view to represent the Regiment in either event is requested to communicate with Captain A. J. Abdy, R.A., R.A. Institution, Woolwich.

The Committee wish to express their regret for the delays which occurred in the transmission to officers of the "Proceedings" for November and December, 1891.

Owing to the free issue to every member of the new "Lists of Ordnance, &c." which accompanied the November number, the bulk for that month was very large. A block ensued at the forwarding office which, owing to sickness of staff, could not be reduced until January.

The Committee hope in future to send out the "Proceedings" in the first week of each month with the Regimental Lists corrected up to the latest possible date of the preceding month.

ROYAL ARTILLERY DINNER CLUB.

Rules.

Officers of the Royal Artillery on full or half-pay, can become annual subscribers at the rate of five shillings per annum, under the following conditions :—

(*a*) On joining the Regiment.
(*b*) If a Subaltern, by payment of five shillings for every year of service up to five years, which shall be the maximum number of years subscription chargeable to officers of that rank on joining.
(*c*) If a Captain, by payment of six years subscriptions.
(*d*) If a Major, by payment of seven years subscriptions.
(*e*) If a Lieut.-Colonel, by payment of eight years subscriptions.

H.R.H. The Commander-in-Chief has approved of the Annual Regimental Dinner taking place on Friday, the 10th June, 1892, at 8 p.m.

The Annual General Meeting of the R.A. Institution will be held in London on the afternoon of 10th June, 1892, and it is hoped will be succeeded by consideration of the R.A. Regimental Charities and Games' Fund.

THE ROYAL ARTILLERY STEEPLECHASES, 1892,

WILL TAKE PLACE ON THE

ALDERSHOT COURSE

(By permission of the General Officer Commanding the Division),

ON THE 30th APRIL,

(UNDER NATIONAL HUNT RULES.)

Full details of races, conditions, arrangements for reaching the course, stands and enclosures, luncheon, &c., will be published and circulated throughout the Regiment early in March.

R.A.I. "DUNCAN" PRIZE ESSAY, 1892.

The Secretary has received Essays bearing mottoes :—

"Cascable."

"Certum pete finem."

HALIFAX, N.S.

The event of greatest importance during the past month was naturally the Duke of Clarence's death, the announcement of which was received at Halifax by all classes with profound regret, and called forth universal expressions of loyalty and sympathy shown in many ways. Owing to the four hours difference in time between London and Halifax, the contents of the cablegram giving the sad news became known, as it were, before the time at which the Duke expired. Later in the day an official cablegram was received from the Adjutant-General, and immediately after that the Royal Standard was hoisted half-mast over the Citadel. Vessels entering the harbour had the intelligence first conveyed to them by the sight of this sad signal, and replied by lowering their own ensigns. Outward bound vessels from England took it to mean that Prince George of Wales was dead, as he was the one who was ill when they sailed from home. The same day (January 14th) the following cablegram was despatched to Sir Francis Knollys, "Please convey to Their Royal Highnesses—deepest sympathy—Officers Royal Artillery and Royal Engineers at Halifax, Nova Scotia," and next day was received an answer "Thanks for kind sympathy," which was as gratifying as it was unexpected. No regimental parties or mess entertainments were given by the R.A. and R.E. until after 26th February.

On the morning of the day of the funeral (January 20th) a memorial service was held at the Garrison Chapel, which was largely attended by both military and civilians. Though the attendance was purely voluntary, every officer and man off duty in the garrison was present, irrespective of the Church to which they belonged. In the afternoon Major Brady's Company fired 60 minute guns from the 9-pr. R.M.L. Saluting Battery on the Citadel Hill, the last gun being fired precisely at sunset when the "Retreat" sounded, and the Royal Standard at the Citadel and the Union Jacks at the out Forts, all at half-mast, were struck simultaneously. It was a cold day, with a N.E. wind, and snow on the ground, so officers and men wore Canadian winter dress, which made them and the guns against the snow-covered glacis, look appropriately sombre and in keeping with the sad honour for which they had been selected, and such, it is hoped, as may not be required of them, nor of any other Company in the Regiment for many years to come.

Major Crookenden and Lieut. Boger, with that portion of No. 3 Company (late No. 23 Battery) now at St. Lucia, are to arrive at Halifax about the middle of March in the hired transport s.s. "Atlas," which will then take half No. 17 Company (late No. 17 Battery) to Devonport. They are going home at "present strength," with the following officers :—Major McDonnell, Capt. Yunge-Bateman, Lieuts. Stuart and Johnston, 2nd Lieut. Lyddon.

The weather at Halifax has been more seasonable lately, and for the last three weeks we have had continuous frost and snow bringing with them all the welcome winter amusements. "Runners" instead of "wheels" have been the order of the day, and the merry sound of sleigh bells is to be heard from morning to night. Nearly every afternoon Major McDonnell, in his well-appointed tandem and fur-robed sleigh, is to be seen starting from the R.A. Park for a drive round the Point Pleasant Park. The snow has been deep enough for snow-shoeing, but

not hard enough to make it anything but heavy going. The roads and paths through the Park look very pretty and the snow-ladened pines give it the appearance of fairyland. There has been some good tobogganning, and at one time a "silver thaw" on the top of snow made it unusually fast. *Apropos* of this, officers who have been at Halifax will be sorry to hear that the old lady Mrs. Chaddock, the owner of Collin's Hill (the great tobogganning ground of Halifax) is dead. For the first time for years a "slide" has been made on the Citadel Hill, chiefly owing to the exertions of Capt. Yunge-Bateman, which for pace and "bunkers" astonished even the natives. The Skating Rink is in full swing, and the band plays there two afternoons and one night a week for subscribers only. The Curling Club which was in liquidation, like the ice, has now been reformed with the hard weather, and there has been some good play, Capt. Boileau and Lieut. Macgowan being the chief military supports of the "Roaring Game."

Sir John Ross has returned from leave with a new personal staff, namely, Major Fergusson, Rifle Brigade, as Military Secretary, and Lieut. White, Grenadier Guards, as A.D.C.

The quotation in the Halifax notes in the January number of the "Proceedings" should read "Exegi monumentum, *ære* perennius," not *ore*.

MALTA.

In November last the R.A. officers played a golf match against the officers Berkshire Regiment (nine a side), and won by 37 holes.

In the same week the R.A. officers defeated the officers of the same regiment at cricket by 37 runs.

At the winter race meeting held in December, two R.A. ponies won races, both being ridden by Mr. Freeland; Colonel Torkington, R.A., also won a race.

A most meritorious victory was obtained by the R.A. crew in the race for the Inter-Regimental Cup, rowed on December 21st. This cup, which is an exceedingly handsome one, was presented by His Excellency the Governor, Sir H. Smythe, under the following conditions, namely, to be rowed for in six-oar in-rigged boats, by officers of regiments quartered in the island. Five crews entered, consisting of the R.A., the Irish Rifles, the Connaught Rangers, the Berks, and the Maltese Militia. The race, which was a most exciting one from start to finish, was rowed in the P. and O. Harbour. The distance (about $1\frac{1}{4}$ miles) being covered in the fastest time ever made over this course. The boats got off to a capital start; after going a short way the Berkshire dropped behind, and at the half distance the Rifles were done with, but from this point onwards a desperate struggle ensued between the R.A., the Connaughts, and the Maltese Militia till within 200 yards of the winning post, when the R.A. crew spurted grandly and won handsomely by about $1\frac{1}{2}$ lengths from the Militia.

Every credit is due to Lieut. Ellershaw for the masterly way in which he stroked his boat, never bustling his crew, he maintained a long and steady stroke throughout the race, and when he called on them for the final spurt they answered gallantly, and won as stated above. The R.A. crew was as follows:—

Major	G. D. Fanshawe	(bow).
"	T. S. Baldock,	2
Lieut.	T. C. W. Molony.	3
"	H. de L. Walters.	4
"	J. F. Fisher.	5
"	A. Ellershaw	(stroke).
"	R. H. Parker	(cox).

An Inter-Regimental Football Challenge Cup (Association Rules) has been

started; the R.A. entered by Companies, two of which, viz., 2 and 27 won their first ties, but were drawn against each other in the second round, 27 winning by three goals to one. In the semi-final 27 Company defeated the Connaught Rangers by two goals to nothing, and they will now meet the Royal Scots in the final.

Polo is in a very flourishing state. There are 22 players in the mess, and the R.A. team ought to have a good look in for the Challenge Cup in March. Col. Torkington has been elected Secretary of the Garrison Polo Club.

A golf handicap was held in December, at which Lieut. Coates, R.A., won the Handicap Challenge Cup; and the R.A., represented by Major Barron and Capt. Montgomery-Campbell were beaten in the final tie for the Regimental Challenge Cup by the representatives of H.M.S. "Surprise," after tieing on the first 18 holes. Capt. Scott and Lieut. Ellershaw also secured prizes in the handicap competition.

The only R.A. lawn tennis player, Capt. Griffin, won the "mixed doubles" competition in the tournament held in January, with the aid of his fair partner.

OBITUARY.

Lieut.-General E. Wray, c.b., Major-General on the retired list, Royal (Bombay) Artillery, died at 11, Harrington Gardens, S.W., after a few days' illness, of broncho-pneumonia, on the 27th January, 1892. He joined the Army, 11th December, 1840; became Captain, 20th January, 1853; Major, 6th June, 1856; Lieut.-Colonel, 18th February, 1861; Colonel, 18th February, 1866; Major-General, 11th October, 1877; and retired with the honorary rank of Lieut.-General, 31st December, 1878. He was employed with the Turkish Contingent from its formation to the end of the war of 1854–55, including seven months at Kertch (brevet of Major, 4th Class of the Medjidie, and Turkish medal). Served in command of the siege train with General Roberts's force at Rajpootana during the Indian Mutiny, and was present at the siege of Ahwa (mentioned in despatches), and Kotah (mentioned in despatches), and pursuit of Tantia Topee (c.b. and medal with clasp).

Major-General J. F. Eaton-Travers, Colonel retired list, Royal Artillery, died at Upham Cottage, Hants, on the 1st February, 1892. He was son of the late Admiral Sir Eaton-Travers, and was 65 years of age. He joined the Royal Artillery, 19th December, 1844; became Captain, 31st August, 1852; Major, 10th September, 1864; Lieut.-Colonel, 6th July, 1867; Colonel, 6th July, 1872; and retired with the honorary rank of Major-General, 13th January, 1875.

Colonel Sir Herbert Bruce Sandford, k.c.m.g., Lieut.-Colonel retired list, Royal (Bombay) Artillery, died at West Hill, St. Leonard's-on-Sea, on the 31st January, 1892, aged 65 years. He was the second son of Sir Daniel Keyte Sandford, d.c.l., m.p. Educated at Addiscombe, he entered the Army in 1844; became Captain, 27th August, 1858; Lieut.-Colonel, 24th March, 1865; and retired with the honorary rank of Colonel, 3rd August, 1865. He was well known as having been associated with great exhibitions. He was assistant to the secretary and manager of the Exhibition of 1862, official delegate and executive commissioner for England at the International Exhibition at Philadelphia in 1875–76, official representative of the Royal Commission at the Melbourne International Exhibition in 1880–1, and secretary and official representative in Australia, Royal Commission, Adelaide Jubilee International Exhibition, 1887. He was knighted for his services at Philadelphia in 1875-76.

Lieut.-Colonel W. A. Kidd, Staff Paymaster, retired list, Army Pay Department, and formerly of the 27th Inniskillings, died at Farnham House, Dublin, on 29th January, 1892, aged 65 years. He joined the Army as Ensign, 20th November, 1846; became Lieutenant, 22nd December, 1848; and served with the 27th Inniskillings in the Indian Mutiny (medal). He became Paymaster R.A., 24th June, 1859, and retired 23rd August, 1882.

Lieut.-General E. Kaye, c.b., retired full pay, Royal (late Bengal) Artillery, died at West Hampstead on the 21st February, 1892. He joined the Honourable East India Company's service June, 1835. The following are his war services:—Afghan War, 1839–40, pursuit of Dost Mahomed, skirmish near Bamian, pursuit of Usbeg troops; Sutlej Campaign, 1845–6, battles of Moodkee, Ferozeshur and Sobraon, as Brigade Major (despatches *London Gazette*, 27th March and 1st April, 1846), medal with two clasps; Punjaub Campaign, 1848–9, served as Brigade Major at the battles of Chillianwallah and Goojerat (despatches *London Gazette*, 3rd March and 19th April, 1849), medal with two clasps, brevet of Major; Indian Mutiny, 1857–8–9, siege, assault, and final capture of Delhi; served also in the operations of the passage of the river Gogra and in the subsequent operations (despatches *London Gazette*, 15th December, 1857), medal with clasp, brevet of Lieut.-Colonel.

Lieut.-Colonel H. G. Young, retired, Royal (Bombay) Artillery, died at Worcester, on the 21st February, 1892. He was first commissioned as Lieutenant on 27th August, 1858; became Captain, 3rd January, 1870; Major, 31st December, 1878; and retired with the honorary rank of Lieut.-Colonel, 6th April, 1879.

Captain W. R. Taylor, who died at Florence, on the 15th February, joined the regiment on the 18th December, 1878, became Captain, 12th September, 1886, and had just passed through the Staff College.

Major C. E. H. Cotes, retired, Royal (Bombay) Artillery, died at Acton, on 18th February, 1892. He was commissioned as Second Lieutenant on 12th June, 1846, retired as honorary Major, 1st January, 1867. Served in the Punjaub Campaign of 1848–9, including siege and capture of Mooltan and battle of Goojerat (medal with two clasps).

Captain H. P. Russell, retired, Royal Artillery, who died at Southend, on 14th February, joined the Regiment on 15th January, 1867; became Captain, 9th December, 1878; and retired on a gratuity 13th January, 1886.

Captain and Quarter-Master J. Sculley, Royal Horse Artillery, died at his residence, Wood Street, Woolwich, on the 14th February, after a short illness. The deceased joined the Royal Artillery in 1853, in his 16th year, and during the years 1855–6 served in Turkey in the Osmanli Horse Artillery. On the conclusion of the war he reverted to regimental duty, and rose through various grades until he was commissioned as Quarter-Master in December, 1868, whilst serving in India. He attained the honorary rank of Captain in July, 1881, and was the senior Quarter-Master on the active list of the Army. He died in the 55th year of his age and the 39th year of his service, and was buried with military honours in Charlton Cemetery on Thursday, 18th February, 1892.

DIARY OF FIXTURES.

MARCH.

Days of the Mth.	Week	
1	T	. . . . .
2	W	Ash Wednesday. R.A. Band Concert at Woolwich at 9 p.m. Sacred Music.
3	Th	. . . . .
4	F	Sandown Park March Meeting (2 days) begins.
5	S	. . . . .
6	S	. . . . .
7	M	. . . . .
8	T	. . . . .
9	W	R.A. Band Concert at Woolwich at 3 p.m.
10	Th	. . . . .
11	F	Grand Military Meeting Sandown Park (2 days) begins.
12	S	. . . . .
13	S	. . . . .
14	M	. . . . .
15	T	. . . . .
16	W	R.A. Band Concert at Woolwich at 9 p.m.
17	Th	. . . . .
18	F	. . . . .
19	S	. . . . .
20	S	. . . . .
21	M	Lincoln Spring Meeting begins.
22	T	. . . . .
23	W	R.A. Band Concert at Woolwich at 3 p.m.
24	Th	Liverpool Spring Meeting begins.
25	F	Grand National.
26	S	. . . . .
27	S	. . . . .
28	M	. . . . .
29	T	. . . . .
30	W	R.A. Band Concert at Woolwich at 3 p.m.
31	Th	. . . . .

APRIL.

1	F	. . . . .
2	S	. . . . .
3	S	. . . . .
4	M	Senior Class Officers begins. Firemasters' Class Officers begins.
5	T	Epsom Spring Meeting begins.
6	W	R.A. Band Concert at 9 p.m. City and Suburban.
7	Th	Sandown Park begins.
8	F	R.A. *v.* R.E. Inter-Regimental Racquet and Billiard Matches at Chatham. 1st day.
9	S	R.A. *v.* R.E. Inter-Regimental Racquet and Billiard Matches at Chatham. 2nd day.
10	S	. . . . .
11	M	. . . . .
12	T	. . . . .
13	W	R.A. Band Concert at 3 p.m.
14	Th	. . . . .

Days of the Mth.	Week	APRIL—*Continued.*
15	F	Good Friday.
16	S	. . . . .
17	S	Easter Sunday.
18	M	Bank Holiday.
19	T	Newmarket Craven Meeting begins.
20	W	R.A. Band Concert at St. James's Hall at 3 p.m.
21	Th	. . . . .
22	F	. . . . .
23	S	. . . . .
24	S	. . . . .
25	M	. . . . .
26	T	. . . . .
27	W	. . . . .
28	Th	. . . . .
29	F	Long Course leaves Woolwich.
30	S	R.A. Steeplechases at Aldershot.
		MAY.
1	S	. . . . .
2	M	1st Division Course Lydd begins.
3	T	Newmarket First Spring Meeting begins.
4	W	R.A. Woolwich *v.* R.N. College, at Rectory Field, Charlton.
5	Th	. . . . .
6	F	. . . . .
7	S	1st Division Course Western Forts begins.
8	S	. . . . .
9	M	Position-Finders' Class Officers begins. R.A. Woolwich *v.* Royal Fusiliers.
10	T	. . . . .
11	W	R.A. Officers *v.* N.-C. Officers.
12	Th	. . . . .
13	F	Kempton Park Meeting begins.
14	S	R.A. Woolwich *v.* Shoebury, at Shoebury. 1st Division Field Artillery Course at Okehampton begins (Division from Aldershot).
15	S	. . . . .
16	M	. . . . .
17	T	Newmarket Second Spring Meeting begins.
18	W	. . . . .
19	Th	. . . . .
20	F	. . . . .
21	S	R.A. Woolwich *v.* Blackheath, at Woolwich. 1st Field Gunnery Course at Okehampton begins.
22	S	. . . . .
23	M	. . . . .
24	T	. . . . .
25	W	R.A. Woolwich *v.* Royal Fusiliers.
26	Th	. . . . .
27	F	R.A. *v.* Aldershot Division, at Aldershot.
28	S	R.A. *v.* Aldershot Division, at Aldershot.
29	S	. . . . .
30	M	. . . . .
31	T	Epsom Summer Meeting begins.

PRÉCIS
AND
TRANSLATIONS.

"REVUE D'ARTILLERIE."

REGISTERING PRESSURE-GAUGE APPLICABLE TO ORDNANCE.

BY

LIEUT.-COLONEL F. E. B. LORAINE, LATE R.A.

No. 19 of the *Comptes rendus* of the *Académie des Sciences*, relative to its sitting on the 11th May, 1891, gives an account by Vieille of a registering pressure-gauge applicable to ordnance :—

We have sought to determine the law of development of pressures in the bores of guns up to the moment of their maximum by a development of the ordinary crusher-gauge.

This result has been obtained under conditions of quite unexpected simplicity by the simple provision of a small smoked plate, less than a square centimetre (·155 of a square inch) in area at the head of the crusher. A vibrating lever, during its movement, traces its course on the smoked plate. The lever is fixed on the plate, but is released automatically by the first movement of the crusher piston. This arrangement is equally suited to the powder chamber, or to the bore in front of the driving ring of the projectile.

The value of the period of vibration of the lever being known, it suffices to read with a micrometer the lengths intercepted by the undulations upon the axis of the figure traced on the smoked plate, in order to obtain the value of the pressure in function of the time.

The general results, derived from a study of more than 150 tracings, obtained in naval guns of 14″·5, 10″·6, 9″·4, 6″·2, and 5″·5 calibre, and in military pieces of 3″·5 and 6″ calibre, are as follow :—

1°—The crusher apparatus placed in the powder chamber works statically, that is to say, there is equilibrium at every moment of the crush between the motive pressure and the resistance of the cylinder. This result has even been obtained with powders much more violent than the service ones. It follows therefore that not only does the final resistance of the crushed cylinder measure properly the maximum pressure, but that, by referring to the table of the static compression of cylinders, we may deduce from the compression observed at every

moment the corresponding pressure, and reconstitute afterwards the law of development of the pressure in functions of the time up to the moment of the maximum pressure. The apparatus constitutes therefore a real registering pressure-gauge.

The knowledge of the law of development of the pressures in functions of the time leads naturally to a knowledge of the velocities and of the movements of the projectile in the bore in functions also of the time.

2°—The crusher apparatus placed in front of the driving ring of the projectile works dynamically, as theory led us to expect.

The trials carried out in the 5″·5 naval gun, with the crusher bolt placed a few centimetres in front of the ring, have clearly shown this complete change in the mode of working of the crusher apparatus, as shown by an examination of the tracings obtained in two identical rounds by means of the same apparatus, placed successively, in the powder chamber, and in front of the driving ring of the projectile.

The compressions observed were 0·0528 inches in the powder chamber, and 0·1024 inches in front of the ring. The compression in the powder chamber was effected with comparative slowness in a duration of 12 vibrations of a tuning fork, about ·003 of a second.

The compression produced by the sudden application of the pressure, after the projectile had unmasked the orifice of the crusher placed in front of its ring, was effected in a time inferior to the duration of a half vibration of the vibrating lever. This duration of time, about ·00025 of a second, is very near that assigned by theory to the dynamic compression of a cylinder by an ounce piston. In this case, theory indicates that the compression is double that which would correspond to the pressure to which the apparatus was subjected if that pressure were exerted statically, which is in conformity with the experimental result.

3°—The first researches undertaken by aid of these instruments have also shown clearly the anomalies which characterise the burning of powders in the bores of guns, anomalies which a mere observation of the maximum pressures gave no cause to suspect. These researches have led to a knowledge of the conditions under which the anomalies in the distribution of the pressures may be eliminated.

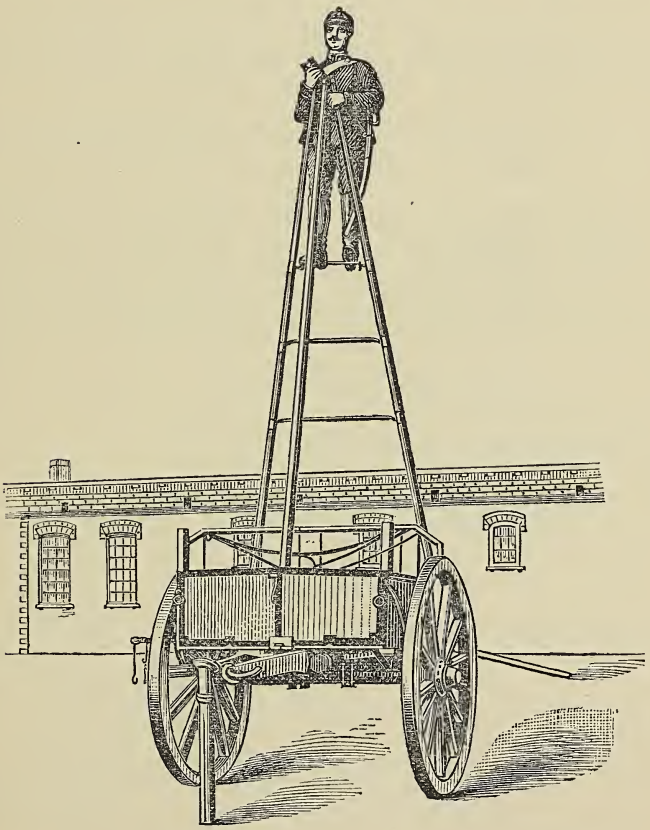
"MILITÄR WOCHENBLATT."

AN OBSERVATION LADDER FOR FIELD ARTILLERY.

PRECIS BY

MAJOR E. S. MAY, R.A.

THIS is an account of a means suggested for facilitating observation from batteries, which has also been made use of, with advantage, by Generals and Staff Officers. Although it may startle our notions a little, and offend some prejudices, it appears to have met with considerable approbation both in Germany and Belgium, where it has been practically tested. A position will rarely combine advantages both for concealment and observation, and batteries may frequently find themselves pitted against an objective which is invisible from the



guns. "It has been felt for the past three years," says our our German author,

" that if an elevated post of observation could be provided for the Commanding Officer of a battery without unduly adding to the weight of the equipment, it would prove a decided boon."

The accompanying sketch will speak for itself, but it may be noted that the ladder is composed of tubular iron rods telescoping into one another, and that it is capable of being set up and taken down very rapidly. It is intended to be raised on an ammunition wagon and can be packed underneath. Three men can fix it in half-a-minute so securely that the wagon can move with it in situ. It weighs 88 lbs., and gives the observer an extra height of 3·5 metres. An improved pattern only weighs 66 lbs. It was practically tested during practice exercises by the German 8th Field Artillery Brigade, and was favourably reported on. It was also tested at Lockstedt by several officers of the other arms of high position. Altogether, independently of these German experiments, similar suggestions have been put forward in Belgium, and an observation ladder, the invention of Lieutenant de Cartres, has actually been introduced into the Belgian service. The construction and method of employment of this one were closely discussed last winter in the *Revue d'Artillerie*, and *Italia militaire e marina*. It is significant that the same necessities have brought about a similar development in both countries.

NOTES

FROM

CORRESPONDING MEMBERS.

ANY member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

THE Records of the Royal Military Academy are about to be re-published in the original form, with additions and drawings, bringing it up to date; the estimated cost will not exceed 12s. 6d. a copy.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

A NEW "Kane's List" having been recently published, and progress having been made in collating relationships of R.A. Officers past and present, Officers are requested to notify to the Secretary, R.A.I., any relationship existing between them and any other officer of the same name registered in "Kane's List."

COPIES of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

THE Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

MAJOR-GENERAL F. W. Stubbs, Retired list, Royal (late Bengal) Artillery, is compiling a List of Officers who have served in the Regiment of Bengal Artillery from its first formation down to its absorption into the Imperial List.

It will consist of about 40 pages 4to, in paper cover. Price, 5s.

Any Officer who may wish to subscribe for a copy, should send his name and address to

Major-General F. W. Stubbs,
Dromiskin House,
Castlebellingham,
Ireland

ROYAL ARTILLERY DINNER CLUB.

RULES.

OFFICERS of the Royal Artillery on full or half-pay, can become annual subscribers at the rate of five shillings per annum, under the following conditions :—

(*a*) On joining the Regiment.

(*b*) If a Subaltern, by payment of five shillings for every year of service up to five years, which shall be the maximum number of years subscription chargeable to officers of that rank on joining.

(*c*) If a Captain, by payment of six years subscriptions.

(*d*) If a Major, by payment of seven years subscriptions.

(*e*) If a Lieut.-Colonel, by payment of eight years subscriptions.

H.R.H. THE COMMANDER-IN-CHIEF has approved of the Annual Regimental Dinner taking place on Friday, the 10th June, 1892, at 8 p.m.

ANNUAL GENERAL MEETING R.A.I.

H.R.H. The Commander-in-Chief, Patron and President of the R.A. Institution, has approved of the Annual General Meeting of the Institution being held at 3 p.m. on Friday, 10th June, in the Lecture Room of the Institution of Civil Engineers, 25, Great George Street, Westminster.

This Lecture Room has been most kindly placed at the disposal of the R.A.I. by the Council of the Institution of Civil Engineers.

At the general Meeting, the Committee intend to bring forward the following resolutions, viz. :—

(1.) That the Committee remain as now constituted; that all Corresponding Members be extra members of the Committee, having a vote when they attend meetings of the Committee; that notice of all Committee Meetings be sent to Corresponding Members, either on home service or on leave at home from abroad.

(2) That all proposed changes of the Rules should be notified in R.A.I. "Proceedings" in, what seems to the Committee, sufficient time before the General Meeting to which such changes are to be submitted to enable Members to form their views on them.

Consequently, that Rule XX. be as follows :—

XX. No alterations or additions to be made to these Rules, unless a notice in writing, specifying the alteration or addition to be proposed, shall have been posted on the Notice Board at the Institution for fourteen days previous to the General Meeting: and unless the alteration or addition shall have been published in the Notes of the R.A.I. "Proceedings" in, what seems to the Committee, sufficient time before the General Meeting.

(3.) That sanction be given for the removal from the Laboratory in the R.A. Institution building of all the furnaces and other fittings, and for the sale of chemicals therein with a view to extending the Museum.

(4.) The Committee submit to the Annual Meeting (in accordance with Rule II., last para.) for election as special honorary members of the Institution the names of the following gentlemen :—

Lieut.-General Sir Evelyn Wood, V.C., G.C.B., &c., &c., Commanding Aldershot Division.

W. Anderson, Esq., M.I.C.E., D.C.L., Director General of Ordnance Factories.

The Committee will be glad to receive suggestions of a subject for the "Duncan" Gold Medal Prize Essay, 1893.

All suggestions will be submitted to the Annual General Meeting for discussion and selection.

The General Meeting will be succeeded by a consideration of the Regimental Charities and probably of the R.A. Games' Fund.

R.A.I. "DUNCAN" PRIZE ESSAY, 1892.

The Secretary has received Essays bearing mottoes :—

"Réculer pour mieux sauter."
"Experience is by industry achieved, &c."
"S'arrêter c'est de rétrograder."
"Arma virumque."
"He, that builds a fair house, &c."
"A raven rising proper."

in addition to those mentioned in March "Proceedings."

THE ROYAL ARTILLERY STEEPLECHASES, 1892,

WILL TAKE PLACE ON THE

ALDERSHOT COURSE

(By permission of the General Officer Commanding the Division),

ON THE 30th APRIL,

(UNDER NATIONAL HUNT RULES.)

In accordance with a resolution passed at the Annual General Meeting, held in London, on the 6th June, 1891, the above Meeting will be held this year at Aldershot, on Saturday, the 30th April.

The average subscriptions amount to about £450 per annum, and before certain additional expenses were incurred, this was sufficient, but as things now stand £600 is required to carry out the Meeting liberally and creditably without drawing on the reserve fund.

All subscribers of £1 and upwards will be furnished with a receipt ticket, which they must bring with them if they attend the races, and on presenting this ticket at either of the pay boxes, they will receive in exchange a free pass for the stand, enclosures, &c.

£1 has been fixed as the minimum subscription entitling the giver to a free pass, but smaller amounts will thankfully be received from those Officers who, though unable to be present, wish to assist in keeping up the Meeting as a regimental institution.

There are 50 good loose boxes at the stables adjoining the Queen's Hotel. Application should be made to Mr. F. Spicer, Southampton Road, Farnborough, Hants. The charge will be 5s. per night, including hay and straw, but not corn.

Special trains will run both to Aldershot and Fleet Stations. The latter is the nearest Station to the Course, being a little over two miles. Arrangements will be made for conveyances meeting the special trains at Fleet, the usual charge being 1s. 6d. to 2s. a head. Ambulances will, if possible, be furnished by the Royal Artillery at Aldershot to convey subscribers to the Course from Fleet Station, at a small charge. The hour of departure of the special trains will be advertised in the sporting papers a day or so before the Meeting.

All letters connected with subscriptions should be addressed to Mr. E. H. Garland, R.A. Department, Messrs. Cox and Co., 16, Charing Cross, S.W., while correspondence connected with the racing proper, or any special matter, should be addressed to the Secretary.

R.A. LUNCHEON CLUB.

There will be a Club luncheon at the Royal Artillery Regimental Meeting at Aldershot, on Saturday, 30th April, on which occasion all Officers of the Regiment will be considered Honorary Members of the Club and will be entitled to all the privileges of Members.

The price of the tickets will be as follows :—Luncheon (with champagne) from 1 to 3.30, and tea after 4 p.m., 7s. 6d. Tea and light refreshments only after 4 p.m., 1s. 6d.

Members holding 7s. 6d. tickets to have the *entrée* to the tent all the time it is open, but guests once only to luncheon and once to tea.

Members must give up their tickets the first time they enter the tent, taking in exchange pass checks for re-admission.

The list will be closed on Friday, 22nd April, and the number of tickets then ordered, plus the estimated number of regimental guests, will be given to the Contractor as his guarantee. Should the number of tickets collected exceed the guarantee, all unused tickets will be given credit for, if returned to Mr. Garland,

Messrs. Cox and Co., 16, Charing Cross, London, S.W., on or before Saturday, 7th May.

On and after 23rd April, the price of the tickets for luncheon and tea will be raised to 10s., and for tea and light refreshments only to 2s. These tickets can be obtained either from Mr. Garland or from the Club official at the luncheon tent.

Members are requested to order their tickets, which must be pre-paid, as early in April as possible from Mr. Garland, stating, at the time, the number of guests' tickets they will require.

HALIFAX, N.S.

An insignificant Baptist minister has succeeded in causing a sensation by making an untruthful and scurrilous attack on the garrison of Halifax. In the course of a speech delivered at a temperance meeting held in a public hall here, he said it was impossible to advance the cause of temperance in Halifax as long as it was a garrison town, that the military were not Christians, not even the Army Chaplains, and that when a Halifax man wanted to marry he had to proceed elsewhere to find a wife. The latter insinuation against the purity of the maidens of the "city by the sea" drew down upon the rev. gentleman the full wrath of the local press, which, to do it justice on this occasion, also took up the cudgels for the military, and the utterer of the libel received a very severe metaphorical chastisement, not unaccompanied by threats of personal violence. A few days afterwards a full and abject withdrawal and apology appeared in all the newspapers signed by this so-called minister of the gospel, who at the same time forwarded an original copy of his letter to the G.O.C. The military treated the affair with silent contempt, and it would not be worth mentioning here except that the libel was copied into the Canadian, American, and English papers, and the apology was not.

On 12th February, an amusing entertainment, called "Mrs. Jarley's Wax-works," was given at the Academy of Music (as the local theatre is styled) under the management of the wife of an officer of the Leicestershire Regiment, for charity. The figures were various ladies and gentlemen dressed up to impersonate all kinds of characters. They were grouped in a semicircle at the back of the stage and carried to the front one by one by two attendants (Lieutenant Marsh, R.A., and Lieutenant Elliot, R.A.), whose humorous gag contributed considerably towards the success of the show. A very prominent figure amongst the wax-works was Lieutenant R. E. Stuart, R.A., who appeared as "Peptonized Ale and Beef," and sang an explanatory song, which must have been a good advertisement for the dietetic staples he represented.

Lieut. J. M. Macgowan, R.A., has sustained a serious loss in the death of his valuable and well-bred racing pony, "The Tramp," which was brought about by a sleighing accident. His man was driving the pony in a sleigh round a corner when one of the "runners" caught in a tram rail, upset the sleigh, and threw the man out. The pony bolted with the empty sleigh and received such injuries she had to be shot. This is the second pony Lieutenant Macgowan has lost through driving accidents since he has been quartered here. In this case he is bringing an action at law against the "Halifax Street Railway Company" for keeping their track in a dangerous condition.

A farewell dinner was given at the R.A.R.E. Mess to Colonel Goldie, whose term of office as Chief Staff Officer, Dominion of Canada, which he has held for five years, has just expired. Colonel Goldie is an old Carbineer officer, and has had a great deal of Staff service in India. He was the purchaser of the Canadian Remounts which attracted so much interest at home some years ago. His successor, Colonel Dudley North, late 47th Foot, has arrived in Halifax. Colonel Goldie has a son in the Royal Artillery, who is at present serving in the 8th Field Battery at Ferozepore.

The brief interval which occurred between the cessation of mourning for

H.R.H. the late Duke of Clarence (February 26th) and the beginning of Lent (March 2nd) was made the most of as regards gaiety and entertainments, the event of greatest importance being the production on Shrove Tuesday of Robertson's famous four-act comedy, "School," by the amateurs of Halifax. This play requires no less a caste that 17 persons, namely, 8 gentlemen and 9 ladies, 8 of whom are school girls. The R.A. were represented by Captain Duffus, who played the part of that aged *roué*, "Beau Farintosh," extremely well, and Lieut. Elliott, who made a nimble noiseless "Footman," and having nothing to say on the stage, no doubt made up for it behind the scenes.

The Nova Scotian Provincial Legislature was formally opened on 3rd March for its annual session by the Lieutenant-Governor with the usual ceremony. The Halifax Garrison Artillery (Militia) fired a salute of 15 guns, and a guard of honour was formed by the 63rd Rifles (Militia). There was a very bad snowstorm at the time, and it was an interesting sight to see the latter trudging through the snow, which was driving in their faces, and the band playing all the time. The Lieutenant-Governor (Mr. Daly) wore diplomatic uniform, and was accompanied by his own staff; he was also supported by the Commanding Officers of the British Regiments in garrison, who, with their Adjutants, attended voluntarily as a compliment to him. The ceremony of opening takes place in the Council Chamber of the Province Building, a handsome room, the walls of which are covered with paintings of Kings and Queens of England, and by-gone Governors of Nova Scotia, who, in the pre-confederation days, were generally distinguished statesmen or soldiers sent out from home, such as Lord Mulgrave, Sir Fenwick Williams, or Sir Hastings Doyle. But to return to the function itself, the Council Chamber is the place of meeting of the Legislative Council (Upper House), the members of which, numbering about a dozen, sit on two rows of seats facing each other, at one end of the passage thus formed is the "Throne," at the other end a barrier, at each side are spectators. The ceremony is a mimic representation of the opening of the Imperial Parliament at home. The gentlemen of the House of Assembly (Lower House) are first summoned, and troop in, headed by their Speaker, who wears a full-bottomed wig. He stands at the barrier, exactly opposite the "Throne." Then comes the speech from the "Throne," which is read by the Lieutenant-Governor himself. It reviews the past, describes the present, anticipates the future, and is accompanied by frequent raisings of the gubernatorial cocked hat whenever he addresses himself alternately or collectively to "Mr. President and Honourable Gentlemen of the Legislative Council," or "Mr. Speaker and Gentlemen of the House of Assembly." The end of the speech concludes the ceremony, the Lieutenant-Governor takes his departure, the band plays, the guard of honour presents arms, and it is all over till this time next year.

The 4th March was the fourth anniversary of a very sad event, the sensational death by accidental drowning out of a boat of 2nd Lieut. E. C. Vallentin, R.A., off Sambro Island, near Halifax.

Major McDonnell, R.A., and Lieutenant Enthoven, R.E., have returned from a three weeks' trip, on leave, in Canada and the States, during which they visited Quebec, Montreal, Toronto, Niagara, Buffalo, and New York, and received much hospitality on all sides.

No small stir was caused amongst the officers here by reports received in private letters by the last mail that the financial condition of Messrs. Cox & Co. is unsound. Further reports have now been received of a reassuring kind, and Messrs. Cox & Co. have written a letter to the O.C.R.A. refuting what has been said, and forwarding a balance-sheet to be posted in the Mess.

Lieutenant J. M. Macgowan, R.A., has just returned from Margaret's Bay with the two first salmon of the season, which he killed himself in the Indian River (20 miles from Halifax), on March 8th and 10th. They are fine fresh run fish and weigh 7 lbs. each.

DIARY OF FIXTURES.

APRIL.

Days of the Mth.	Week	
1	F	. . . . .
2	S	. . . . .
3	S	. . . . .
4	M	Senior Class Officers begins. Firemasters' Class Officers begins.
5	T	Epsom Spring Meeting begins.
6	W	R.A. Band Concert at 9 p.m. City and Suburban.
7	Th	Sandown Park begins.
8	F	R.A. *v.* R.E. Inter-Regimental Racquet and Billiard Matches at Chatham. 1st day.
9	S	R.A. *v.* R.E. Inter-Regimental Racquet and Billiard Matches at Chatham. 2nd day.
10	S	. . . . .
11	M	. . . . .
12	T	. . . . .
13	W	R.A. Band Concert at 3 p.m.
14	Th	. . . . .
15	F	Good Friday.
16	S	. . . . .
17	S	Easter Sunday.
18	M	Bank Holiday.
19	T	Newmarket Craven Meeting begins.
20	W	R.A. Band Concert at St. James's Hall at 3 p.m.
21	Th	. . . . .
22	F	. . . . .
23	S	. . . . .
24	S	. . . . .
25	M	. . . . .
26	T	. . . . .
27	W	. . . . .
28	Th	. . . . .
29	F	Long Course leaves Woolwich.
30	S	R.A. Steeplechases at Aldershot.

MAY.

1	S	. . . . .
2	M	1st Division Course Lydd begins.
3	T	Newmarket First Spring Meeting begins.
4	W	R.A. Woolwich *v.* R.N. College, at Rectory Field, Charlton.
5	Th	. . . . .
6	F	. . . . .
7	S	1st Division Course Western Forts begins.
8	S	. . . . .

MAY—*Continued.*

Days of the Mth.	Week	
9	M	Position-Finders' Class Officers begins. R.A. Woolwich *v.* Royal Fusiliers.
10	T	. . . . .
11	W	R.A. Officers *v.* N.-C. Officers.
12	Th	. . . . .
13	F	Kempton Park Meeting begins.
14	S	R.A. Woolwich *v.* Shoebury, at Shoebury. 1st Division Field Artillery Course at Okehampton begins (Division from Aldershot).
15	S	. . . . .
16	M	. . . . .
17	T	Newmarket Second Spring Meeting begins.
18	W	. . . . .
19	Th	. . . . .
20	F	. . . . .
21	S	R.A. Woolwich *v.* Blackheath, at Woolwich. 1st Field Gunnery Course at Okehampton begins.
22	S	. . . . .
23	M	. . . . .
24	T	. . . . .
25	W	R.A. Woolwich *v.* Royal Fusiliers.
26	Th	. . . . .
27	F	R.A. *v.* Aldershot Division, at Aldershot.
28	S	R.A. *v.* Aldershot Division, at Aldershot.
29	S	. . . . .
30	M	. . . . .
31	T	Epsom Summer Meeting begins.

JUNE.

1	W	The Derby.
2	Th	R.A. *v.* Gentlemen of M.C.C., at Lords.
3	F	R.A. *v.* Gentlemen of M.C.C., at Lords. The Oaks.
4	S	R.A. Woolwich *v.* Blackheath, at Rectory Field, Charlton.
5	S	Whit Sunday.
6	M	R.A. *v.* Free Foresters, at Woolwich. Bank Holiday.
7	T	R.A. *v.* Free Foresters, at Woolwich.
8	W	R.A. *v.* Household Brigade, at Burton's Court, Chelsea. 2nd Div. Field Artillery Course at Okehampton begins.
9	Th	R.A. *v.* Household Brigade, at Burton's Court, Chelsea.
10	F	Annual General Meeting R.A.I. R.A. Regimental Dinner.
11	S	R.A. Woolwich *v.* Shoeburyness, at Woolwich. Long Course go to Lydd. 2nd Division Course Western Forts begins.
12	S	. . . . .
13	M	2nd Division Course at Lydd begins.
14	T	Ascot begins.
15	W	. . . . .
16	Th	. . . . .
17	F	R.A. *v.* R.E., at Chatham.
18	S	R.A. *v.* R.E., at Chatham.
19	S	. . . . .
20	M	R.A. *v.* R.M.A., at R.M. Academy, Woolwich.
21	T	R.A. *v.* R.M.A., at R.M. Academy, Woolwich.
22	W	R.A. *v.* Yorkshire Gentlemen, at Woolwich.

Days of the Mth.	Week	JUNE—*Continued.*
23	Th	R.A. *v.* Yorkshire Gentlemen, at Woolwich. Sandown Park 1st Summer Meeting begins.
24	F	R.A. *v.* B.B., at Woolwich. Long Course leaves Lydd.
25	S	R.A. *v.* B.B., at Woolwich.
26	S	. . . . .
27	M	R.A. *v.* Oxford Authentics, at Woolwich.
28	T	Newmarket 1st July Meeting begins. Old Shoebury *v.* Shoebury.
29	W	Old Shoebury *v.* Shoebury.
30	Th	Oxford *v.* Cambridge.
		JULY.
1	F	Oxford *v.* Cambridge.
2	S	Oxford *v.* Cambridge. Kempton Park 1st Summer Meeting.
3	S	. . . . .
4	M	3rd Division Field Artillery Course at Okehampton begins.
5	T	Stockbridge Meeting begins.
6	W	R.A. *v.* Harlequins, at Woolwich. 2nd Field Gunnery Course at Okehampton begins.
7	Th	R.A. *v.* Harlequins, at Woolwich.
8	F	Eton *v.* Harrow.
9	S	Eton *v.* Harrow. 3rd Division Course Western Forts begins.
10	S	. . . . .
11	M	. . . . .
12	T	Newmarket 2nd July Meeting begins.
13	W	R.A. *v.* Greenjackets, at Winchester.
14	Th	R.A. *v.* Greenjackets, at Winchester.
15	F	Sandown Park 2nd Summer Meeting begins.
16	S	. . . . .
17	S	. . . . .
18	M	. . . . .
19	T	. . . . .
20	W	R.A. *v.* Queen's Club, at West Kensington.
21	Th	R.A. *v.* Queen's Club, at West Kensington.
22	F	R.A. *v.* R.E., at Woolwich.
23	S	R.A. *v.* R.E., at Woolwich.
24	S	. . . . .
25	M	3rd Division Course at Lydd begins.
26	T	Goodwood begins.
27	W	. . . . .
28	Th	. . . . .
29	F	R.A. *v.* Mote Park, at the Mote. 4th Division Field Artillery Course at Okehampton begins.
30	S	R.A. *v.* Mote Park, at the Mote.
31	S	. . . . .

7

PRÉCIS

AND

TRANSLATIONS.

"REVUE D'ARTILLERIE."

THE FIELD GUN OF THE FUTURE.

A CRITICAL EXAMINATION OF GENERAL WILLE'S RECENT WORK.

BY

GUSTAVE MOCH, *Capitaine d'artillerie.*

PRÉCIS BY

Lieut.-Colonel F. E. B. Loraine, *late* R.A.

General Wille's proposal for a complete reconstruction of the German field artillery has been prompted, perhaps half unconsciously, by a conviction that the existing German field guns are decidedly inferior to those of the French. Captain Moch is however of opinion that the field gun of the future predicted by the General has but little chance of being adopted.

General Wille indeed deprecates all discussion; all through his work he preaches that practice is better than theory and adopts as his motto: "Try everything, and retain only what is good"—a rather expensive formula in such matters. The General, not having however made a gun according to his ideas nor any ammunition, it is difficult to conceive how the practice can be acquired. In point of fact his work is purely theoretical throughout, and his many critics in the German, Austrian and Italian military press dwell on the *practical* impossibility of carrying out his ideas. Here is how he states his programme: "My proposals tend to establish a field gun as practically a magnified example of the modern infantry rifle, satisfying the following conditions: small calibre, high muzzle velocity, heavy projectile and of high transverse density,[1] great efficiency, lightness relatively considerable, and an altogether satisfactory mobility."

[1] That is, high weight by reference to calibre, in other words, a *long* projectile.

The *Militär Wochenblatt* at once pointed out that inasmuch as the modification of the rifle had eventually reduced the weight of its projectile by one half, so, if the General's assimilation of the two systems were to hold good, should we see the weight of our shrapnel reduced from 14 to 7 lbs. Whereas the opposite tendency is observed, and rightly so, in field artillery.

General Wille meets this objection by saying that although the rifle bullet has decreased in weight it has increased in transverse density.

But the General fails to observe that the length of projectile should decrease proportionally to the calibre, for he gives to his projectile a higher transverse density than is given to pieces of larger calibre, thereby unduly increasing the pressures in the bore.

Without placing undue emphasis on that feature of his system it may here be pointed out how very different are the functions assigned respectively to a field gun and a rifle on the field of battle.

A rifle requires the flattest possible trajectory, therefore high muzzle velocity, so as to increase the dangerous zone of its fire and to admit of its being fired at a certain distance without raising the back sight, and the ideal to be sought in a rifle is plainly one of which the height of trajectory should never exceed the height of a man.

But a field gun should at least be enabled to fire over the heads of its own infantry, and its essential at all ranges is a high remaining velocity for the effective delivery of its shrapnel bullets.

Here however are the General's figures and proposals :—

Gun, carriage, limber and wagon, of one and the same model for all batteries.
Calibre, 2·756 inches.
Length of gun, 40 calibres (9 feet 2 inches).
Weight of gun, 7 cwt. 3 qrs. 10 lbs.
Projectiles : common and shrapnel shells with double action fuzes.
Weight of projectile, 14 lbs. 5 oz.
,, ,, charge, 3 lbs. 5 oz. Nobel powder (approx.)
,, ,, cartridge, 18 lbs. 12 oz.
,, ,, carriage, 10 cwt. 3 qrs.
,, ,, limber with 30 rounds, 16 to 17 cwt.
Gun weight behind team, 34 to 35 cwt.
Weight of wagon body with 42 rounds, 17 cwt. 2 qrs.
Wagon weight behind team, 33 to 34 cwt.
Muzzle velocity, 2625 f.s. *at least.*

Captain Moch points out how much the science of gun making is in advance of that of gun carriage construction, and suggests that no one has yet arrived at building a field carriage of adequate strength to withstand the shock of discharge of a gun far inferior in energy to that suggested by General Wille. As regards the gun itself too, who shall say that with our present explosives and metallurgical knowledge it is possible to produce a field gun, having so high a velocity, with any of the elements of endurance and capacity to do long continuous work that we are accustomed to expect from such pieces. Captain Moch further insists on the greater importance of remaining velocity at long ranges than of muzzle velocity, and clearly sets forth the various conditions which make for that result. He then quits the ground of generalities and passes to a comparison of the three guns mentioned in the following tables,

selected as superior in initial and remaining energy to all other European guns of 3·6-inch calibre, excepting the French gun of that calibre.

	British 12-pr. of 1884.	French 80mm of 1877.	Spanish 80mm Sotomayor.
Calibre, ...ins.	3	3·15	3·14
Weight of projectile, ...lbs.	12	13·845	13·89
Muzzle velocity, ...f.s.	1720	1526	1509
Muzzle energy, ... foot-tons	246	223	219
Weight of gun, ... cwt.	7	8·33	5·59
Energy per cwt. of gun, foot-tons	35	27	39

If we accept General Wille's ideas the British gun is far superior to the French one. The calibre is less, the projectile proportionally heavier, the muzzle velocity and energy are higher, likewise the energy relative to weight of gun, and finally the gun is much lighter.

Let us now see how this initial strength fares afterwards by a comparison of the remaining velocities at various ranges.

Range in Yards.	Remaining velocity in f.s.		
	British gun.	French gun.	Spanish gun.
—	1720	1526	1509
1100	1220	1168	1217
2200	965	994	1014
3300	824	886	873
4400	715	817	771

We see that at 2000 yards and upwards the French gun of a seven years earlier model is more powerful than the British one, and is in point of fact superior in ballistic power at the usual ranges than any other field gun in Europe. Captain Moch adds that at ranges of 5500, 6600, and 7700 yards the remaining velocities of the 80mm *obus à mitraille* are respectively 770, 748, and 745 feet, that is, superior to the remaining velocities of all other European guns at 4400 yards.

The higher muzzle velocity of the British gun is obtained at the cost of a stronger and more complicated carriage than its rival, and we have seen of how little real service that velocity is. The British gun complete without limber gunners carries six more rounds than the French one, and weighs rather more than 36 cwt., while the latter weighs but 32 cwt. The latter is the French Horse Artillery gun. Their field gun of 3·6-inch calibre gives to the team a weight of about 41 cwt. It is of course a more powerful gun than the British 12-pr.

To turn to the Spanish gun it is rather better than the French gun at mean ranges and slightly inferior to it at long ranges. But this slight inferiority is more than compensated by a light carriage weighing only about $5\frac{1}{2}$ cwt. against the 11 and 10 cwt. of the French and British guns respectively. Curiously enough in connection with this advantage there is a limber which weighs as much as $12\frac{1}{2}$ cwt. empty, being constructed to carry the same number of rounds as the British gun. So that a Spanish gun team has to draw a weight of about 31 cwt. while a French one draws about 32 cwt.

To sum up the relative merits of the three guns we see that the high muzzle velocity of the British gun does not avail to give it as high a relative energy as the Spanish gun, while as regards mobility and remaining velocity at mean ranges the latter has a distinct advantage.

Captain Moch then passes to a discussion of the weight of projectile suggested by General Wille and gives the following table of European field ordnance :—

Powers.	Field Batteries.			Horse Batteries.		
	Calibre in ins.	Common shell. Weight in lbs.	Shrapnel shell. Weight in lbs.	Calibre in ins.	Common shell. Weight in lbs.	Shrapnel shell Weight in lbs.
Germany	3·52	15·45	17·75	3·52	15·45	17·75
England	3·00	12·00	12·00	3·00	12·00	12·00
Austria	3·48	14·00	15·75	2·96	9·53	10·52
France	3·60	Nil.	19·10	3·16	Nil.	13·82
Italy	3·48	14·87	15·31	2·96	9·42	9·83
Russia	3·48	15·20	15·57	3·48	15·20	15·57

He agrees with General Wille that the days of case shot are numbered. There must be few artillerymen who would not welcome its disappearance forthwith. For the past 20 years the writer of this précis has been fully convinced of its futility.

Captain Moch cannot believe that England will remain satisfied with a 12-pr. field gun, and presumes that we shall in course of time produce the 20-pr. that has been for some time in contemplation.

NEW EXPERIMENTS WITH SMOKELESS POWDER.

REPORT OF EXPERIMENTS AT HERR KRUPP'S FACTORY.

PRECIS BY

MAJOR E. S. MAY, R.A.

SMOKELESS powders have hitherto been viewed with considerable suspicion from a service standpoint owing to their sensitiveness to the hygrometic condition of the atmosphere. If we are to trust Herr Krupp, chemical science has now mastered the difficulty, and he is possessed of powder whose stability leaves nothing to be desired.

The following is a short précis of the results arrived at.

In order to test what effect the state of the atmosphere was capable of producing, samples, weighing two kilogrammes, of four different natures of prism powder of various sized grains were exposed freely to the air for one year. These samples were carefully weighed every four weeks, and the quantity of moisture absorbed was judged by the alterations in weight. These variations were found at the end of the year to range from a loss of 1·6 grammes to an increase of 1·6 grammes, or, in other words, the powder lost or gained ·08 per cent. of its weight in dampness during that time.

These results were considered very satisfactory when compared with the experiences gained when black powder was similarly tested, when the variations are stated to have been five times as great. The treatment of the grains with graphite, which had been adopted to obviate the chance of their striking together, appears to have materially contributed towards security against damp.

The dangerous effect of a high temperature on smokeless powder is well known to everyone who has used such an explosive for sporting purposes, and has been well exemplified in the accident on board the "Admiral Duperré" (noticed some time ago in these "Proceedings"), when a 34^{cm} gun burst owing to the magazine in which the ammunition was stored having become unduly heated. Herr Krupp contends that we need no longer fear such accidents with smokeless powder.

He subjected his powder to a temperature of between 40° and 60° centigrade for a continuous period, at first of four, and afterwards of 15 days. The metal cases which held the cartridges are stated to have become so hot that they could not be handled with the hand unprotected.

Experiments showed that the muzzle velocity of the 8·7^{cm} gun, which with powder at a normal temperature (17° centigrade) was 624 metres, rose to 645 metres when powder was used which had been kept at 50° centigrade for 15 days.

The pressure of the gas similarly was only increased from 2320 to 2560 atmospheres, while the uniformity of the pressures developed throughout the bore were at the same time found to have been but little altered.

NOTES

FROM

CORRESPONDING MEMBERS.

ANY member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

IN order to bring the already existing printed Records of the R. M. Academy up to date, it has been found that there will be a much larger amount of letter-press to be added than was at first anticipated. In consequence of this it has become necessary to raise the estimated price per copy from 12s. 6d. to 15s.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

A NEW "Kane's List" having been recently published, and progress having been made in collating relationships of R.A. Officers past and present, Officers are requested to notify to the Secretary, R.A.I., any relationship existing between them and any other officer of the same name registered in "Kane's List."

COPIES of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

THE Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

MAJOR-GENERAL F. W. Stubbs, Retired list, Royal (late Bengal) Artillery, is compiling a List of Officers who have served in the Regiment of Bengal Artillery from its first formation down to its absorption into the Imperial List.

It will consist of about 40 pages 4to, in paper cover. Price, 5s.

Any Officer who may wish to subscribe for a copy, should send his name and address to

Major-General F. W. Stubbs,
Dromiskin House,
Castlebellingham,
Ireland

THE Institution has lately received two most handsome presents.

The first is a picture in oils of Major Jas. Wightman who was a Sergeant and Sergeant-Major of the R.H.A. through the Peninsular War and at Waterloo, presented by his son Major Wightman, late 11th Hussars.

The second is the complete set of medals and decorations of the late Colonel Sir W. Robe, K.C.B., &c., R.A., and of his son Lieutenant W. Livingstone Robe, R.H.A., presented by Miss Vimiera Robe, daughter of Sir William, and last surviving member of his family.

Except Colonel Walford's medals, it is many years since the Institution has received presents of such value, both intrinsic and historical, and for them the Committee, in the name of the Regiment, have tendered thanks to Miss Robe and Major Wightman.

ROYAL ARTILLERY DINNER CLUB.

Rules.

Officers of the Royal Artillery on full or half-pay, can become annual subscribers at the rate of five shillings per annum, under the following conditions :—

(*a*) On joining the Regiment.

(*b*) If a Subaltern, by payment of five shillings for every year of service up to five years, which shall be the maximum number of years subscription chargeable to officers of that rank on joining.

(*c*) If a Captain, by payment of six years subscriptions.

(*d*) If a Major, by payment of seven years subscriptions.

(*e*) If a Lieut.-Colonel, by payment of eight years subscriptions.

H.R.H. The Commander-in-Chief has approved of the Annual Regimental Dinner taking place on Friday, the 10th June, 1892, at 8 p.m.

ANNUAL GENERAL MEETING R.A.I.

H.R.H. The Commander-in-Chief, Patron and President of the R.A. Institution, has approved of the Annual General Meeting of the Institution being held at 3 p.m. on Friday, 10th June, in the Lecture Room of the Institution of Civil Engineers, 25, Great George Street, Westminster.

This Lecture Room has been most kindly placed at the disposal of the R.A.I. by the Council of the Institution of Civil Engineers.

At the general Meeting, the Committee intend to bring forward the following resolutions, viz. :—

(1.) That the Committee remain as now constituted ; that all Corresponding Members be extra members of the Committee, having a vote when they attend meetings of the Committee; that notice of all Committee Meetings be sent to Corresponding Members, either on home service or on leave at home from abroad.

(2) That all proposed changes of the Rules should be notified in R.A.I. "Proceedings" in, what seems to the Committee, sufficient time before the General Meeting to which such changes are to be submitted to enable Members to form their views on them.

Consequently, that Rule XX. be as follows :—

XX. No alterations or additions to be made to these Rules, unless a notice in writing, specifying the alteration or addition to be proposed, shall have been posted on the Notice Board at the Institution for fourteen days previous to the General Meeting: and unless the alteration or addition shall have been published in the Notes of the R.A.I. "Proceedings" in, what seems to the Committee, sufficient time before the General Meeting.

(3.) That sanction be given for the removal from the Laboratory in the R.A. Institution building of all the furnaces and other fittings, and for the sale of chemicals therein with a view to extending the Museum.

(4.) The Committee submit to the Annual Meeting (in accordance with Rule II., last para.) for election as special honorary members of the Institution the names of the following gentlemen :—

Lieut.-General Sir Evelyn Wood, V.C., G.C.B., &c., &c., Commanding Aldershot Division.

W. Anderson, Esq., M.Inst.C.E., D.C.L., F.R.S., Director General of Ordnance Factories.

The Committee will be glad to receive suggestions of a subject for the "Duncan" Gold Medal Prize Essay, 1893.

All suggestions will be submitted to the Annual General Meeting for discussion and selection.

The General Meeting will be succeeded by a consideration of the Regimental Charities and probably of the R.A. Games' Fund.

R.A.I. "DUNCAN" PRIZE ESSAY, 1892.

The Secretary has received Essays bearing mottoes :—

"Recte quod honeste."
"Moveo et profiteor."
"I am so."
"Let us now praise famous men."
"They also serve who only stand and wait."
"Bis dat qui cito dat."
"The criterion of a battery is its, &c."
"Practice makes perfect."
"Unhasting yet unresting work."
"Aye, but why did we beat 'em?"
"Para bellum."
"Steady boys, steady."

in addition to those mentioned in April "Proceedings."

ALDERSHOT.

ROYAL ARTILLERY POINT-TO-POINT.

The Royal Artillery at Aldershot held their Annual Point-to-Point Races, by kind permission of Mr. Shrubb, at Merristwood near Guildford, on April 13th. A good horse-shoe course of about four miles had been selected, and the country, thanks to the overnight's rain, rode well. Unfortunately a cold, sleety rain fell during most of the day, but notwithstanding, a good day's sport was enjoyed, thanks to the farmers who so kindly allowed their land to be ridden over.

Good entries were obtained both for the light and heavy weight races. In the former seven met the starter behind Mr. Shrubb's house, at about three o'clock, and went away at a steady pace, as the line led them at once down a somewhat steep plough to the second obstacle which consisted of banks in and out of a narrow lane; after this Rocket took the field along at a smart pace, followed immediately by Schottische, Kathleen and Leprechaun for about 2½ miles when Schottische, who had dropped back third, raced up to the leader and the pair went away at a spanking pace for about ½ a mile. On nearing the winning-post Leprechaun drew up to the leaders, and the last fence, consisting of two somewhat solid looking bars of new timber, was charged simultaneously by Leprechaun and Schottische and a good race home ended in favour of the former by half a length. Gypsy fell but came in fifth. Starters :—

Mr. F. O'Connor's Leprechaun ..... Owner 1
Mr. W. A. M. Thompson's Schottische ..... Owner 2
Mr. H. L. Powell's Rocket ..... Capt. A. King 3
Mr. S. W. Blacker's Kathleen ..... Owner 4
Capt. N. Young's Gypsy ..... Owner 0
Mr. G. F. Dickson's Marigold ..... Owner 0
Mr. R. Thomson's Gazelle ..... Owner 0

Shortly after the conclusion of the above race the Welters were despatched on their journey. Starting at a great pace they were led by Pilgrim, who fell at the first fence, but was quickly remounted, and a couple of fields further on resumed a strong lead; but, running a little wide at the second turn, he was passed by Cordite and Tom. About half-a-mile from home Pilgrim again resumed the lead, which he maintained to the end, winning comfortably by about ten lengths from Cordite. Royal and Nora Creina fell. Starters:—

Capt. J. Dawkins's PILGRIM	OWNER 1
Capt. J Keir's CORDITE	OWNER 2
Major F. Eustace's TOM	OWNER 3
Capt. G. E. Benson's REPEATER	OWNER 4
Mr. W. Strong's GREY FRIARS	Owner 0
Capt. C. M. Barlow's ROBERT THE DEVIL	Owner 0
Mr. H. L. Powell's ROYAL	Owner 0
Capt. W. Macbean's ALL FOURS	Owner 0
Capt. R. Stuart's BILLY	Owner 0
Mr. R. Thomson's HUNGRY BOY	Owner 0
Mr. Bowring's NORA CREINA	Mr. O'Connor 0

HALIFAX, N.S.

ON 25th March three service rounds of Palliser shot were fired from the 10-inch B.L. Mark I. 32-ton gun which was mounted at Fort McNab last summer. Although the firing was only for the purpose of testing the mountings and fittings and was not directed at a target, it was nevertheless an event of some importance as it is the first B.L. gun which has been fired in British North America, and perhaps this sentiment, coupled with a fine day, accounted for the distinguished party which crossed over to McNab's Island in the steam launch that morning. Those present were General Sir John Ross, the Lieutenant Governor of Nova Scotia (Mr. Daly), Colonel Ryan, R.A., Colonel Hill, R.E., nearly all the R.A. and R.E. officers in the command, two officers of the Leicestershire Regiment, and several ladies, not to mention children. The arrangements for firing the gun were made by Lieut.-Colonel A. A. Saunders, R.A., who calculated the quadrant elevation with great exactitude, the shot striking the water just where it was intended to even at 10,000 yards range. Lieutenant Macgowan, R.A., acted as Group Officer, which was appropriate, as he did the bulk of the work last summer of landing the gun at Halifax, taking it across the harbour and landing it again on McNab's Island.

On the 26th March the hired transport "Atlas" arrived at Halifax from St. Lucia, and disembarked late No. 23 Battery Western Division R.A., under the command of Major Crookenden, the only other officer being Lieutenant Boger. They were played up to the Citadel from the Dockyard by the band of the Leicestershire Regiment. The Battery has been over seven years in the West Indies, and the men look as yellow as guineas, though otherwise fit. It is rather early in the year for troops to arrive in a climate like that of Nova Scotia from the tropics, and as a precaution the Canadian winter clothing of this Battery was sent down to St. Lucia in advance; unfortunately the vessel carrying it met with a disaster which necessitated part of the cargo being jettisoned, amongst it being the winter clothing; then a second supply was despatched from Halifax, and as it could not reach St. Lucia before the "Atlas" sailed it was sent to Bermuda "to be left till called for." When that will be is not known, as the "Atlas" was not allowed to call there in consequence of having developed a suspected case of yellow fever on the voyage from St. Lucia, and so

the Battery arrived at Halifax without its winter clothing after all, but it was issued to them immediately they got here; they were not allowed to do any duty until they were fitted with the clothing. The head-quarters of No. 3 Company, under the command of Major Brady, of which they now form a part, made ample and hospitable preparations for the new-comers, who found everything they could want ready for them on arrival.

The "Atlas" is a small Cunard steamer of 1500 tons. The suspected yellow fever cases turned out to be nothing, though if they had one would not have felt much surprise, as she had been employed carrying "Blacks" backward and forward between the West Indies and the West Coast of Africa before starting on the reliefs of Batteries Royal Artillery, and the conveyance to England of the time-expired men, invalids, and other details of three Line Regiments. These same suspected yellow fever cases have cost the British Government a pretty penny, including 10 days demurrage of the "Atlas" at Halifax at £50 a day, the cost of sending the Bermuda Details to Halifax by freight steamer and the Jamaica Details to England by Royal Mail Steamer. The "Atlas" entered Halifax flying the "Yellow Jack" at the fore, but quickly received *prâtique* from the Health Officer as, whether she had yellow fever or not, the disease cannot live in this latitude, so much so that when they get a case in the Civil Hospital here they do not isolate it.

OBITUARY.

Major-General J. F. Raper, Colonel retired list, Royal (late Bengal) Artillery, died at 13, Sussex Gardens, W., on the 6th March, 1892, aged 63. He joined the Army, December 4th, 1844; became Captain, August 27th, 1858; Lieut.-Colonel, August 1st, 1872; Colonel, August 1st, 1877; and hon. Major-General on retirement, December 31st, 1878. He served in the Punjab Campaign, 1848–49, including the first and second siege operations before Mooltan, with surrender of the fortress and battle of Goojerat (medal with two clasps).

Major M. J. Barlow, R.A., was killed on Wednesday, the 16th March, 1892, whilst playing polo at Agra, where his Battery (the 9th Field) is stationed. He joined the Regiment 15th December, 1871; became Captain, 2nd July, 1881; and Major, 1st October, 1887. He served in the Egyptian War of 1882, and was present at Tel-el-Kebir (medal with clasp, and Khedive's star).

Major Sir Robert M. Mundy, K.C.M.G., late Royal Artillery, died at Holybank, Emsworth, Hants, on the 22nd March, 1892, aged 78 years. He was youngest son of the late Mr. E. M. Mundy, of Shipley Hall, Derbyshire. He joined the Royal Artillery in June, 1833; became Captain, March, 1841; Brevet-Major, October, 1846; and retired upon half-pay, October, 1847. He served as Lieut.-Colonel in the Osmanli Horse Artillery from March, 1855, to August, 1856 (Fourth Class of the Medjidie). He was appointed Governor of Grenada, September, 1863; administered the government of the Windward Islands from April to December, 1865, and from June, 1868, to April, 1869; also that of British Guiana from May, 1866, to September, 1867; and of the Leeward Islands during the absence of Sir B. Pine in 1871; was Governor of British Honduras, 1874–77 (C.M.G., 1874); K.C.M.G. on his retirement from from the Colonial Service in 1877.

Lieut.-Colonel Sir Charles Larcom, Bart., Retired List, late Royal Artillery, died at the Firs, Whetstone, on the 28th March, 1892. He joined the Royal Artillery, 18th December, 1861; became Captain, 10th February, 1875; Major, 18th December, 1881; and Lieut.-Colonel, 31st December, 1887. He served in the New Zealand War in 1863–64, and was present in the actions of Katikara and Kaitak—wounded in the shoulder (mentioned in despatches). Commanded a detachment of Artillery engaged at Sentry Hill (medal).

Lieut.-Colonel E. S. Beamish, Retired List, Royal (late Bombay) Artillery, died at Eltham, on the 17th April, 1892, aged 66 years. He obtained his first commission 13th December, 1845; became Captain, 27th August, 1858; and Major, 5th July, 1872; retiring on full pay, with the honorary rank of Lieut.-Colonel, 1st August, 1872.

INTER-REGIMENTAL

RACQUET AND BILLIARD MATCHES.

R.A. *v.* R.E.

Played at Chatham, April 8th and 9th, 1892.

DOUBLE RACQUETS.

PLAYED AT 2.45 P.M., 8TH.

R.A.		R.E.
CAPTAIN COOPER-KEY. & LIEUT. & CAPTAIN QUINTON.	*v.*	CAPTAIN HAMILTON. & LIEUT. BLAIR.

Rubber of 7 Games.

1st Game.	*2nd Game.*	*3rd Game.*	*4th Game.*
R.A. 15.	R.A. 15.	R.A. 15.	R.A. 15.
R.E. 6.	R.E. 12.	R.E. 5.	R.E. 5.

SINGLE RACQUETS.

PLAYED AT 10.30 A.M., 9TH.

R.A.		R.E.
CAPTAIN COOPER-KEY.	*v.*	CAPTAIN HAMILTON.

Rubber of 5 Games.

1st Game.	*2nd Game.*	*3rd Game.*
R.A. 15.	R.A. 15.	R.A. 15.
R.E. 12.	R.E. 6.	R.E. 7.

DOUBLE BILLIARDS.

PLAYED IN R.E. MESS, AT 4.30 P.M., 8TH.

R.A.		R.E.
CAPTAIN CURTEIS. & CAPTAIN POLLOCK.	*v.*	COLONEL GLANCY. & CAPTAIN ROBERTS.

51 all.

78.		100.
191.		201.
200.		242.
221.		251.
	275 all.	
	282 all.	
300.		291.

SINGLE BILLIARDS.

Played 10.15 p.m., 8th.

R.A.		R.E.
CAPTAIN POLLOCK	*v.*	COLONEL GLANCY
	40 all.	
	49 all.	
	75 all.	
94.		100.
171.		201.
275.		300.
	336 all.	
401.		370.
501.		469.

R.A. & R.E. Annual Racquet and Billiard Matches.

The results of the Racquet and Billiard Matches up to and including the present year are shewn below :—

1873.

Racquets.			*Billiards.*		
Double. R.A. 1.		R.E. 4.	*Double.* R.A. 500.		R.E. 497.
Lieut. W. E. Denison.		Lieut. L. K. Scott.	Lieut.-Col. Drayson.		Capt. Seton.
" W. L. Davidson.		" S. M. Maycock.	Major Maitland.		" Mant.
Single. R.A. 2.		R.E. 3.	*Single.* R.A. 500.		R.E. 361.
Lieut. W. L. Davidson.		Lieut. S. M. Maycock.	Major Maitland.		Capt. Mant.

1874.

Racquets.			*Billiards.*		
Double. R.A. 4.		R.E. 1.	*Double.* R.A. 500.		R.E. 492.
Major Newman.		Lieut. L. K. Scott.	Major Maitland.		Capt. Warburton.
Lieut. Crookenden.		" Tower.	Lieut. Anstruther.		" Seton.
Single. R.A. 0.		R.E. 3.	*Single.* R.A. 370.		R.E. 500.
Lieut. Crookenden.		Lieut. Tower.	Major Maitland.		Capt. Warburton.

1875.

Racquets.			*Billiards.*		
Double. R.A. 0.		R.E. 4.	*Double.* R.A. 500.		R.E. 494.
Capt. Anderson.		Lieut. Tower.	Capt. Hazlerigg.		Major Warburton.
Lieut. Crookenden.		" *Hon.* M. G. Talbot.	Lieut. Anstruther.		Capt. Skinner.
Single. R.A. 0.		R.E. 3.	*Single.* R.A. 286.		R.E. 500.
Capt. Anderson.		Lieut. Tower.	Lieut. Anstruther.		Major Warburton.

1876.

Racquets.			*Billiards.*		
Double. R.A. 3.		R.E. 4.	*Double.* R.A. 500.		R.E. 451.
Major Murdoch.		Lieut. Penrose.	Capt. Hutchinson.		Major Warburton.
Lieut. Anstruther.		" Onslow.	Lieut. Anstruther.		Capt. Skinner.
Single. R.A. 1.		R.E. 3.	*Single.* R.A. 479.		R.E. 500.
Major Murdoch.		Lieut. Penrose.	Lieut. Anstruther.		Major Warburton.

1879.

Racquets.			*Billiards.*		
Double. R.A. 4.		R.E. 0.	*Double.* R.A. 500.		R.E. 430.
Capt. Griffiths.		Capt. L. K. Scott.	Major Hutchinson.		Major Seton.
Lieut. D. C. Carter.		Lieut. W. A. Cairnes.	Capt. Anstruther.		Capt. Glancy.
Single. R.A. 3.		R.E. 1.	*Single.* R.A. 500.		R.E. 421.
Lieut. D. C. Carter.		Lieut. W. A. Cairnes.	Capt. Anstruther.		Capt. Glancy.

1880.

Racquets.

Double.	R.A. 4.	R.E. 0.	
Lieut. King.		Lieut. R. S. Hedley.	
" Cooper-Key.		" W. A. Cairnes.	
Single.	R.A. 0.	R.E. 3.	
Lieut. D. C. Carter.		Lieut. W. A. Cairnes.	

Billiards.

Double.	R.A. 500.	R.E.	430
Major Hutchinson.		Major Manderson.	
Capt. Anstruther.		Capt. Glaney.	
Single.	R.A. 458.	R.E.	500.
Capt. Anstruther.		Major Manderson.	

1881.

Racquets.

Double.	R.A. 4.	R.E. 0.	
Lieut. King.		Lieut. S. M. Mayeoek.	
" Cooper-Key.		" W. A. Cairnes.	
Single.	R.A. 3.	R.E. 1.	
Lieut. Cooper-Key.		Lieut. W. A. Cairnes.	

Billiards.

Double.	R.A. 500.	R.E.	392.
Major Hutchinson.		Capt. Glaney.	
Capt. Anstruther.		" Broadfoot.	
Single.	R.A. 500.	R.E.	468.
Capt. Anstruther.		Major Mant.	

1882.

Racquets.

Double.	R.A. 4.	R.E. 2.	
Lieut. C. D. King.		Lieut. Tower.	
" Cooper-Key.		" Friend.	
Single.	R.A. 3.	R.E. 1.	
Lieut. Cooper-Key.		Lieut. Tower.	

Billiards.

Double.	R.A. 300.	R.E.	252.
Col. Maitland.		Major Seton.	
Lieut. Bruen.		Major Glaney.	
Single.	R.A. 500.	R.E.	437.
Col. Maitland.		Major Seton.	

1883.

Racquets.

Double.	R.A. 1.	R.E. 4.	
Lieut. C. D. King.		Lieut. Tower.	
" Cooper-Key.		" Friend.	
Single.	R.A. 1.	R.E. 3.	
Lieut. C. D. King.		Lieut. Tower.	

Billiards.

Double.	R.A. 267.	R.E.	300.
Col. Maitland.		Lieut. Bor.	
Capt. Anstruther.		Lieut. Dumbleton.	
Single.	R.A. 500.	R.E.	297.
Capt. Anstruther.		Lieut. Dumbleton.	

1884.

Racquets.

Double.	R.A. 3.	R.E. 4.	
Lieut. Cooper-key.		Lieut. Tower.	
" C. D. King.		" Friend.	
Single.	R.A. 2.	R.E. 3.	
Lieut. Cooper-Key.		Lieut. Tower.	

Billiards.

Double.	R.A. 277.	R.E.	300.
Lieut.-Col. Hazlerigg.		Lieut. Dumbleton.	
Capt. Anstruther.		Capt. Digby.	
Single.	R.A. 500.	R.E.	398.
Capt. Anstruther.		Lieut. Dumbleton.	

1885.

Racquets.

Double.	R.A. 4.	R.E. 2.	
Lieut. Cooper-Key.		Capt. Friend.	
" C. D. King.		Lieut. Hamilton.	
Single.	R.A. 3.	R.E. 1.	
Lieut. Cooper-Key.		Capt. Friend.	

Billiards.

Double.	R.A. 300.	R.E.	274.
Major Anstruther.		Capt. Digby.	
Capt. MacMahon.		" Baddeley.	
Single.	R.A. 500.	R.E.	248.
Major Anstruther.		Capt. Digby.	

1890.

Racquets.

Double.	R.A. 1.	R.E. 4.	
Captain Cooper-Key.		Lieut. Hedley.	
Lieut. Simonds.		" Sheppard.	
Single.	R.A. 0.	R.E. 3.	
Captain Cooper-Key.		Lieut. Hedley.	

Billiards.

Double.	R.A. 235.	R.E.	300.
Major Anstruther.		Captain Digby.	
Lieut. Laehlan.		" Dumbleton.	
Single.	R.A. 500.	R.E.	489.
Major Anstruther.		Captain Dumbleton.	

1891.

Racquets.

Double.	R.A. 2.	R.E. 4.	
Captain Cooper-Key.		Captain Hedley.	
2nd Lieut. Galloway.		2nd Lieut. Sheppard.	
Single.	R.A. 3.	R.E. 2.	
Captain Cooper-Key.		Captain Hedley.	

Billiards.

Double.	R.A. 300.	R.E. 250.	
Major Anstruther.		Colonel Glancy.	
Lieut. Pollock.		Capt. Hedley.	
Single.	R.A. 444.	R.E. 500.	
Major Anstruther.		Colonel Glancy.	

1892.

Racquets.

Double.	R.A. 4.	R.E. 0.	
Captain Cooper-Key.		Captain Hamilton.	
Lieut. & Capt. Quinton.		Lieut. Blair.	
Single.	R.A. 3.	R.E. 0.	
Captain Cooper-Key.		Captain Hamilton.	

Billiards.

Double.	R.A. 300.	R.E. 291.	
Captain Curteis.		Colonel Glancy.	
Captain Pollock.		Captain Roberts.	
Single.	R.A. 500.	R.E. 469.	
Captain Pollock.		Colonel Glancy.	

DIARY OF FIXTURES.

MAY.

Days of the Mth.	Week	
1	S	
2	M	1st Division Course Lydd begins.
3	T	Newmarket First Spring Meeting begins.
4	W	R.A. Woolwich *v.* R.N. College, at Rectory Field, Charlton.
5	Th	
6	F	
7	S	1st Division Course Western Forts begins.
8	S	
9	M	Position-Finders' Class Officers begins. R.A. Woolwich *v.* Royal Fusiliers.
10	T	
11	W	R.A. Officers *v.* N.-C. Officers.
12	Th	
13	F	Kempton Park Meeting begins.
14	S	R.A. Woolwich *v.* Shoebury, at Shoebury. 1st Division Field Artillery Course at Okehampton begins (F.A. from Aldershot).
15	S	
16	M	
17	T	Newmarket Second Spring Meeting begins.
18	W	
19	Th	
20	F	
21	S	R.A. Woolwich *v.* Blackheath, at Woolwich. 1st Field Gunnery Course at Okehampton begins.
22	S	
23	M	
24	T	
25	W	R.A. Woolwich *v.* Royal Fusiliers.
26	Th	
27	F	R.A. *v.* Aldershot Division, at Aldershot.
28	S	R.A. *v.* Aldershot Division, at Aldershot.
29	S	
30	M	
31	T	Epsom Summer Meeting begins.

JUNE.

1	W	The Derby.
2	Th	R.A. *v.* Gentlemen of M.C.C., at Lords.
3	F	R.A. *v.* Gentlemen of M.C.C., at Lords. The Oaks.
4	S	R.A. Woolwich *v.* Blackheath, at Rectory Field, Charlton.
5	S	Whit Sunday.
6	M	R.A. *v.* Free Foresters, at Woolwich. Bank Holiday.

Days of the Mth.	Week	JUNE—*Continued.*
7	T	R.A. *v.* Free Foresters, at Woolwich.
8	W	R.A. *v.* Household Brigade, at Burton's Court, Chelsea. 2nd Div. Field Artillery Course at Okehampton begins (R.H.A. from Woolwich).
9	Th	R.A. *v.* Household Brigade, at Burton's Court, Chelsea.
10	F	Annual General Meeting R.A.I. R.A. Regimental Dinner.
11	S	R.A. Woolwich *v.* Shoeburyness, at Woolwich. Long Course go to Lydd. 2nd Division Course Western Forts begins.
12	S	. . . . .
13	M	2nd Division Course at Lydd begins.
14	T	Ascot begins.
15	W	. . . . .
16	Th	. . . . .
17	F	R.A. *v.* R.E., at Chatham.
18	S	R.A. *v.* R.E., at Chatham.
19	S	. . . . .
20	M	R.A. *v.* R.M.A., at R.M. Academy, Woolwich.
21	T	R.A. *v.* R.M.A., at R.M. Academy, Woolwich.
22	W	R.A. *v.* Yorkshire Gentlemen, at Woolwich.
23	Th	R.A. *v.* Yorkshire Gentlemen, at Woolwich. Sandown Park 1st Summer Meeting begins.
24	F	R.A. *v.* B.B., at Woolwich. Long Course leaves Lydd.
25	S	R.A. *v.* B.B., at Woolwich.
26	S	. . . . .
27	M	R.A. *v.* Oxford Authentics, at Woolwich.
28	T	Newmarket 1st July Meeting begins. Old Shoebury *v.* Shoebury.
29	W	Old Shoebury *v.* Shoebury.
30	Th	Oxford *v.* Cambridge.

JULY.

1	F	Oxford *v.* Cambridge.
2	S	Oxford *v.* Cambridge. Kempton Park 1st Summer Meeting.
3	S	. . . . .
4	M	3rd Division Field Artillery Course at Okehampton begins (F.A. from Weedon).
5	T	Stockbridge Meeting begins.
6	W	R.A. *v.* Harlequins, at Woolwich. 2nd Field Gunnery Course at Okehampton begins.
7	Th	R.A. *v.* Harlequins, at Woolwich.
8	F	Eton *v.* Harrow.
9	S	Eton *v.* Harrow. 3rd Division Course Western Forts begins.
10	S	. . . . .
11	M	. . . . .
12	T	Newmarket 2nd July Meeting begins.
13	W	R.A. *v.* Greenjackets, at Winchester.
14	Th	R.A. *v.* Greenjackets, at Winchester.
15	F	Sandown Park 2nd Summer Meeting begins.
16	S	. . . . .
17	S	. . . . .
18	M	. . . . .
19	T	. . . . .
20	W	R.A. *v.* Queen's Club, at West Kensington.
21	Th	R.A. *v.* Queen's Club, at West Kensington.

JULY—*Continued.*

Days of the Mth.	Week	
22	F	R.A. *v.* R.E., at Woolwich.
23	S	R.A. *v.* R.E., at Woolwich.
24	**S**	
25	M	3rd Division Course at Lydd begins.
26	T	Goodwood begins.
27	W	
28	Th	
29	F	R.A. *v.* Mote Park, at the Mote. 4th Division Field Artillery Course at Okehampton begins (F.A. from Hilsea).
30	S	R.A. *v.* Mote Park, at the Mote.
31	**S**	

AUGUST.

1	M	
2	T	
3	W	R.A. *v.* I.Z., at Woolwich.
4	Th	R.A. *v.* I.Z., at Woolwich.
5	F	
6	S	4th Division Course at Western Forts begins.
7	**S**	
8	M	
9	T	
10	W	R.A. Woolwich *v.* Charlton Park, at Woolwich.
11	Th	
12	F	
13	S	R.A. Officers *v.* N.C. Officers.
14	**S**	
15	M	
16	T	
17	W	
18	Th	
19	F	
20	S	
21	**S**	
22	M	
23	T	5th Division Field Artillery Course at Okehampton begins (Division from Exeter).
24	W	
25	Th	
26	F	
27	S	
28	**S**	
29	M	
30	T	
31	W	

NOTES

FROM

CORRESPONDING MEMBERS.

Any member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

In order to bring the already existing printed Records of the R. M. Academy up to date, it has been found that there will be a much larger amount of letter-press to be added than was at first anticipated. In consequence of this it has become necessary to raise the estimated price per copy from 12s. 6d. to 15s.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

A new "Kane's List" having been recently published, and progress having been made in collating relationships of R.A. Officers past and present, Officers are requested to notify to the Secretary, R.A.I., any relationship existing between them and any other officer of the same name registered in "Kane's List."

Copies of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

The Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

Major-General F. W. Stubbs, Retired list, Royal (late Bengal) Artillery, is compiling a List of Officers who have served in the Regiment of Bengal Artillery from its first formation down to its absorption into the Imperial List.

It will consist of about 40 pages 4to, in paper cover. Price, 5s.

Any Officer who may wish to subscribe for a copy, should send his name and address to

Major-General F. W. Stubbs,
Dromiskin House,
Castlebellingham,
Ireland

The Committee again this month have pleasure in announcing the receipt of another present to the Institution; this time one of great antiquarian interest.

It consists of five ebony shells of various shapes and sizes; the largest is nearly spherical, of 16 inches diameter, the others are elongated. Their manufacture is of a complicated design, and the Committee hope to get some Member to describe and represent them in an early Number of the "Proceedings."

They were found with some twenty-five others at Ahmednugger in an old disused well, and were brought home and presented to the Institution by Surgeon-Lieut.-Colonel H. J. Waller-Barrow, A.M.S.

The Life of the late Colonel Duncan, C.B., R.A., M.P., by the Rev. H. B. Blogg, M.A., with an introduction by the Lord Bishop of Chester, is now to be obtained through the R.A.I. at 2s. 8d.

It is a work that should be in the Library of every R.A. Mess, as it contains much of interest about Regimental History.

"Field Artillery Fire," by Captain W. L. White, R.A., is complete, with the last chapter appearing in this Number. A reprint in pamphlet form is published at the R.A. Institution, where copies may be obtained, price 1s. each.

At the Conversazione of The Royal Society, May 4th, 1892, Captain H. C. L. Holden, R.A., exhibited no less than 10 Electrical Instruments, of which a full description is appearing in a series of articles in "Electricity," commencing 20th May, one of these instruments has been adapted to, or invented for work in connection with the science of Artillery, by Captain Holden, and the honour done him by this exhibition may be duly appreciated.

ALDERSHOT.

ROYAL ARTILLERY RACES.

Once more the Regimental Races have been favoured with exceptionally fine weather, and the move to Aldershot would seem to be in the right direction.

Notwithstanding the appeals to officers to give long notice of what luncheon tickets they would require, there was a large demand for tickets on the spot, with the result that those who lunched late were somewhat crowded.

Very many thanks are due to the Aldershot R.A. Mess authorities for the help given by them to the Club contractor.

As this is the first really large Lunch for which the contractor has had to cater, Members of the Club should be well satisfied with the result; doubtless the experience gained will be of great help in future, and it is hoped that those who availed themselves of privilege of Honorary Membership will promptly join the R.A. Luncheon Club.

Besides the Regimental Races detailed below, there were three open races, bringing out fields of three, eight and two respectively.

Clerk of the Course and Stakeholder: Colonel S. H. Toogood. Handicapper: Mr. G. H. Verrall. Clerk of the Scales and Judge: Mr. H. A. Stevens. Starter: Major M. Bowers, 5th Dragoon Guards.

SATURDAY, 30th APRIL.

The course was in capital order; but still that did not prevent accidents happening to Captain Johnstone and Mr. Lyon, both of whom were riding in the Royal Artillery Gold Cup, the first-named being on the back of Nina, and the latter bestriding Chop and Change. Captain Johnstone had the misfortune to dislocate his shoulder, while Mr. Lyon appeared rather seriously hurt, but was quite right again after a few days rest. Eight turned out for the Royal Artillery Lightweight Steeplechase, 2 to 1 being taken about K.C., but he, like others, had his chance destroyed by running out, the race ultimately falling to Shane O'Neil, who won by ten lengths. For the Royal Artillery Gold Cup nine faced the starter, Rocket, who started at 7 to 2, winning by five lengths. The Royal Artillery Welter Steeplechase attracted five to the post, Royal being supported against the field, but he was early out of the fray by refusing, and Bovril, the outsider of the

party, won a good race by three-parts of a length from Mexico, which brought a very successful meeting to a close in excellent time. Details :—

2.15.—THE ROYAL ARTILLERY LIGHT-WEIGHT STEEPLECHASE of 50 sovs., with 10 sovs. to the second, and 5 sovs. to the third; two miles and-a-half.

Mr. J. McC. Maxwell's b g SHANE O'NEIL, aged, 11 st. 7 lbs...OWNER 1
Mr. R. E. L. Radcliffe's br m NO NAME, aged, 11 st. 7lbs.
MR. THOMPSON 2
Mr. S. W. W. Blacker's br m KATHLEEN, aged, 11 st. 7 lbs....OWNER 3
Capt. C. D. King's THE GENERAL, aged, 11 st. 7 lbs....Capt. A. King 0
Mr. W. F. O'Connor's LEPRECHAUN, 5 yrs., 11st. 7 lbs.....Owner 0
Capt. P. B. Taylor's CHANCE, 6 yrs., 11 st. 7 lbs.....Owner 0
Mr. F. Lyon's NELLIE, aged, 11 st. 7 lbs.....Owner 0
Mr. J. C. Kirk's K.C., 6 yrs., 11 st. 7 lbs. .....Capt. Johnstone 0

Betting 2 to 1 against K.C., 3 to 1 against Leprechaun, 5 to 1 against Shane O'Neil, and 8 to 1 against any other. Shane O'Neil with K.C. and No Name got away together, and ran in close company for two-thirds of the distance, when K.C. dropped back beaten, and No Name took his place, while Kathleen considerably improved her position, but had no chance whatever of catching Shane O'Neil, who came sailing away from the bend into the straight, and won with ease by ten lengths; Kathleen was a bad third. Nellie fourth, Chance fifth, and The General last.

3.30.—THE ROYAL ARTILLERY GOLD CUP, value 100 sovs., with 50 sovs. to the winner, 20 sovs. to the second, and 10 sovs. to the third; three miles.

Mr. H. L. Powell's ROCKET, aged, 12 st. 7 lbs.....MR. BLACKER 1
Capt. G. G. Simpson's ch m CHOPETTE, aged, 12 st. 7 lbs.
CAPT. A. KING 2
Mr. G. Gilson's bl g BOVRIL, aged, 12 st. 7 lbs. (car. 12 st. 8 lbs.)
OWNER 3
Capt. H. M. Sandbach's QUEEN'S BIRTHDAY, aged, 12 st. 7 lbs.
Capt. Hornby 0
Mr. P. Herbert's HOLMWOOD, aged, 12 st. 7 lbs. .....Owner 0
Capt. Goulburn's HAWKWOOD, aged, 13 st. .....Owner 0
Mr. R. C. Wellesley's NINA, aged, 12 st. 7 lbs.....Capt. Johnstone 0
Mr. W. A. M. Thompson's SCHOTTISCHE, aged, 13 st..... ....Owner 0
Mr. M. S. Williams's CHOP AND CHANGE, aged, 12 st. 7 lbs. Mr. Lyon 0

Betting: 5 to 2 each against Chopette and Hawkwood, 7 to 2 against Rocket, 6 to 1 against Queen's Birthday, and 10 to 1 against any other. Rocket for a short distance showed the way to Hawkwood and Chopette, but prior to reaching the water he was pulled back into fourth place, and so they came on past the Stand, but Hawkwood came to grief shortly afterwards, and Rocket again assumed the lead and, making all the remainder of the running, won easily by five lengths. Bovril was third, and Holmwood, the only other that passed the post, was fourth.

4.30.—THE ROYAL ARTILLERY WELTER STEEPLECHASE of 50 sovs., with 10 sovs. to the second, and 5 sovs. to the third; two miles and-a-half.

Mr. G. Gilson's bl g BOVRIL, aged, 13 st. 7 lbs..... .....OWNER 1
Captain Ricardo's bl g MEXICO, aged, 13 st. 7 lbs....CAPT. A. KING 2
Mr. A. F. R. Thomson's b or br g WILD BOY, aged, 13 st. 7 lbs.
MR. HERBERT 3
Capt. H. M. Sandbach's JUPITER, 6 yrs., 13 st. 7 lbs....Capt. Hornby 0
Mr. H. L. Powell's ROYAL, aged, 13 st. 7 lbs.....Mr. Thompson 0

Betting: Evens Royal, 4 to 1 against Mexico, 6 to 1 against Wild Boy and Jupiter, and 10 to 1 against Bovril. Royal and Jupiter got away together and ran as evenly as possible until disappearing up the hill at the back of the stand, where the favourite ran out and Jupiter fell, when Mexico went on with the lead, he being closely attended by Bovril, and who, prior to getting into the straight, had worked his way to the front, and holding that position to the end won a good race by three-quarters of a length. Wild Boy was a bad third, and Jupiter, who was remounted, completed the course.

Besides winning the R.A. Aldershot Welter Point-to-Point Race with Pilgrim, Capt. J. W. Dawkins has this season, riding the same horse, won the Heavy-Weight Point-to-Point Races of the Aldershot Division and Staff College. He was unlucky in not discovering the value of his horse in time to enter him for one of the Regimental Races.

HALIFAX, N.S.

The formation of the new No. 3 Company Western Division, R.A., is now completed, and Major Brady commands the strongest Company in the Regiment—establishment, 316 of all ranks.

There has been quite a small epidemic of scarlet fever amongst the officers in the R.A. and R.E. Mess which cannot be traced to any source. Captain Molony, R.E., Lieutenant Elliot, R.A., and Captain Boileau, R.A. have all had it, and are now convalescent.

Captain J. H. Thomson, R.A., of the Director of Artillery's Department, paid a flying visit from Quebec to inspect some cordite in charge of the Ordnance Store Department at Halifax, to ascertain what effect the Nova Scotian winter had had upon it.

Colonel Noyes, who has been living at Halifax since his retirement from the service last October, has now left the station for England.

Salmon and trout fishing are in full swing, Major Brady and Lieut. Macgowan being the successful fishermen. The latter, in company with Major Waldron, D.A.A.G., has just returned from Mud Lake with a basket of 88 trout, averaging about ¾ lb. weight.

Captain Boileau has been elected Worshipful Master of Virgin Lodge—one of the oldest lodges of Freemasons in Halifax, and one which has always been well supported by the military officers. It was chartered in 1782, but in 1784 its title was changed to "Artillery Lodge," by which it was known until the year 1800, when it resumed the old name of "Virgin Lodge." In 1869 it was transferred from the jurisdiction of the Grand Lodge of England to that of the Grand Lodge of Nova Scotia, under which it now works. The following officers of the Regiment have been, or are members of Virgin Lodge of recent years :—

Lieutenant E. R. A. Kerrison...	...	raised 1877
Captain James Wall	...	affiliated 1879
Major George Firebrace ...	...	do. 1887
Captain A. C. T. Boileau ...	...	raised 1888
Lieut.-Colonel G. A. Noyes ...	...	do. 1890
Second Lieutenant H. M. Elliot ...	...	affiliated 1890
Captain G. S. Duffus	...	do. 1891
Lieut.-Colonel A. A. Saunders ...	...	do. 1892
Lieutenant W. H. Popplestone ...	...	do. 1892

H.M. Ships "Emerald," "Buzzard" and "Pelican," which belong to the

Newfoundland Squadron of the North American Fleet, have put into Halifax on their way to the Newfoundland Fisheries from Bermuda. These men-of-war are looked on here as the harbingers of summer, and there is great rivalry between them and the French *Division Navale de Terre Neuve*, despatched annually from Cherbourg, as to which will first reach the fishing grounds.

MALTA.

At the Malta Garrison Athletic Sports Corporal Morrison, R.A., won the following events:—

100 Yards Flat Race.	880 Yards Flat Race.
440 Yards Flat Race.	Hop, Step and Jump (Army and Navy).
120 Yards Hurdle Race.	One Mile Race.

OBITUARY.

Major G. W. Howard-Vyse, Royal Artillery (commanding the 1st Field Battery at Meerut), died at Srinagar, Kashmir, on the 29th April, 1892, aged 38. He joined the Royal Artillery 29th April, 1873, became Captain, 1st October, 1882, and Major, 1st April, 1890. He served in the Afghan War in 1878–79, with the Candahar Force, and afterwards with the 2nd Division of the Peshawur Field Force (medal).

Lieutenant J. A. Rich, R.H.A., entered the Regiment in 1885, four months before he completed his eighteenth year. The youngest officer who has joined since the Crimean War. Full of promise, a thorough horseman and gallant rider, he is a real loss to the Regiment, as well as to the many brother officers and men to whom he had endeared himself. He died at Umballa on 17th May of enteritis.

Colonel (temporary Major-General) W. H. Noble, half-pay, R.A., Superintendent of the Royal Gunpowder Factory, Waltham Abbey, died at Thrift Hall, Waltham, on 17th May, 1892. In 1856 General Noble competed as a university man for and won a direct commission in the Ordnance Corps. He was then a student at Trinity College, Dublin, and had just taken his degree (B.A.), with honours in experimental sciences. In March, 1856, he was appointed a Lieutenant in the Royal Artillery. In 1859 he took his Master's degree (M.A.) in Trinity College, Dublin. In 1861 he was selected to succeed his namesake, Captain Andrew Noble, C.B., as Associate Member of the Ordnance Select Committee, for the purpose of carrying out ballistic and other scientific gunnery experiments. He served with the Ordnance Select Committee from 1861 until its dissolution in 1868. He was then appointed to the staff of the Director-General of Ordnance, and subsequently became a member of the experimental branch of the Director of Artillery's Department at Woolwich. He served in this capacity from 1865 to 1876, during which time he was either a member or secretary of numerous Ordnance Committees, such as the Special Committee on Explosive Substances, Special Committee on Guncotton, Committee on Range-Finders, Special Committee on Field Artillery Equipment, Committee on Iron Armour, etc. In 1876, after a period of 15 years' continuous service on duties connected with scientific

gunnery, having arrived at the rank of Major, he was posted to a Field Battery, but immediately afterwards was ordered to proceed to the United States as British judge of weapons at the Centennial Exhibition. He served as member and secretary of the group of Judges of Awards in the War Section, and, under a special permit from the Commander-in-Chief of the United States Army, he visited nearly all the arsenals, magazines and manufacturing establishments of war material in that country. After a short leave of absence he was, in January, 1877, ordered to proceed to India as member and acting-secretary of a Special Committee, appointed by Lord Salisbury, in connection with the reorganisation of the Ordnance Department of the Indian Army, including the manufacturing establishments of the three presidencies. He served with this Commission from February, 1876, to November, 1878, when, on the breaking out of the Afghan War, he was nominated Staff Officer of the siege train of the Candahar Field Force. He organised the train at Sukhan, and commanded it on its march across the Sind Desert and through the Bolan. In 1880 he was appointed to the command of a Battery of Artillery at Woolwich until April, 1881, when he was nominated a member of the Ordnance Committee, that appointment being for three years. In April, 1884, he again returned to regimental duty as a Lieut.-Colonel, and in July, 1885, he was appointed Superintendent of the Royal Gunpowder Factory at Waltham Abbey. Very large quantities of prismatic gunpowders (E.X.E. and S.B.C.) have been successfully made, both at Waltham Abbey and by contract, on his registered designs, and under the patent which, with the permission of the War Department, was granted to him in 1886. General Noble was the author of many works on military subjects, and the inventor of several scientific instruments relating to the manufacture of guns and gunpowder. His illness was due to an attack of cholera in the Afghan War, from the effects of which he never quite recovered.

Lieutenant C. E. O'Leary, R.A., who died at Srinagar, Kashmir, on 3rd May, 1892, joined the Regiment on 5th July, 1884.

DIARY OF FIXTURES.

JUNE.

Day of the Mth.	Wk.	Regimental.	Cricket, &c.	Private.
1	W	... ...	The Derby.	... ...
2	Th	... ...	R.A. *v.* Gentlemen of M.C.C. at Lords.	... ...
3	F	... ...	R.A. *v.* Gentlemen of M.C.C. at Lords. The Oaks.	... ...
4	S	... ...	... ...	... ...
5	**S**	... ...	Whit Sunday.	... ...
6	M	... ...	R.A. *v.* Free Foresters, at Woolwich. Bank Holiday.	... ...
7	T	... ...	R.A. *v.* Free Foresters, at Woolwich.	... ...
8	W	2nd Division F.A. Course at Okehampton begins(R.H.A. from Woolwich).	R.A. *v.* Household Brigade, at Burton's Court, Chelsea.	... ...
9	Th	... ...	R.A. *v.* Household Brigade, at Burton's Court, Chelsea.	... ...
10	F	Annual General Meeting R.A. Instn. R.A. Regtl. Dinner	... ...	... ...
11	S	Long Course go to Lydd. 2nd Div. Course Western Forts begins.	R.A. Woolwich *v.* Shoebury-ness, at Woolwich.	... ...
12	**S**	... ...	... ...	... ...
13	M	2nd Div. Course at Lydd begins.	... ...	... ...
14	T	... ...	Ascot begins.	... ...
15	W	... ...	... ...	... ...
16	Th	... ...	... ...	... ...
17	F	... ...	R.A. *v.* R.E., at Chatham.	... ...
18	S	... ...	R.A. *v.* R.E., at Chatham.	... ...
19	**S**	... ...	... ...	... ...
20	M	... ...	R.A. *v.* R.M.A., at R.M. Academy, Woolwich.	... ...
21	T	... ...	R.A. *v.* R.M.A., at R.M. Academy, Woolwich.	... ...
22	W	... ...	R.A. *v.* Yorkshire Gentle-men, at Woolwich.	... ...
23	Th	... ...	R.A. *v.* Yorkshire Gentle-men, at Woolwich. San-down Park 1st Summer Meeting begins.	... ...
24	F	Long Course leaves Lydd.	R.A. *v.* B.B., at Woolwich.	... ...
25	S	... ...	R.A. *v.* B.B., at Woolwich.	... ...
26	**S**	... ...	... ...	... ...
27	M	... ...	R.A. *v.* Oxford Authentics, at Woolwich.	... ...
28	T	... ...	Newmarket 1st July Meet-ing begins. Old Shoebury *v.* Shoebury.	... ...
29	W	... ...	Old Shoebury *v.* Shoebury.	... ...
30	Th	... ...	Oxford *v.* Cambridge.	... ...

JULY.

Day of the Mth.	Wk.	Regimental.	Cricket, &c.	Private.
1	F	... ...	Oxford *v.* Cambridge.	... ...
2	S	... ...	Oxford *v.* Cambridge. Kempton Park 1st Summer Meeting.	... ...
3	S	... ...	... ...	... ...
4	M	3rd Division F.A. Course at Okehampton begins (F.A. from Weedon).	... ...	... ...
5	T	... ...	Stockbridge Meeting begins.	... ...
6	W	2nd Field Gunnery Course at Okehampton begins.	R.A. *v.* Harlequins, at Woolwich.	... ...
7	Th	... ...	R.A. *v.* Harlequins at Woolwich.	... ...
8	F	... ...	Eton *v.* Harrow.	... ...
9	S	3rd Div. Course Western Forts begins.	Eton *v.* Harrow.	... ...
10	S	... ...	... ...	... ...
11	M	... ...	... ...	... ...
12	T	... ...	Newmarket 2nd July Meeting begins.	... ...
13	W	... ...	R.A. *v.* Greenjackets, at Winchester.	... ...
14	Th	... ...	R.A. *v.* Greenjackets, at Winchester.	... ...
15	F	... ...	Sandown Park 2nd Summer Meeting begins.	... ...
16	S	... ...	... ...	... ...
17	S	... ...	... ...	... ...
18	M	... ...	... ...	... ...
19	T	... ...	... ...	... ...
20	W	... ...	R.A. *v.* Queen's Club, at West Kensington.	... ...
21	Th	... ...	R.A. *v.* Queen's Club, at West Kensington.	... ...
22	F	... ...	R.A. *v.* R.E., at Woolwich.	... ...
23	S	... ...	R.A. *v.* R.E., at Woolwich.	... ...
24	S	... ...	... ...	... ...
25	M	3rd Div. Course at Lydd begins.	... ...	... ...
26	T	... ...	Goodwood begins.	... ...
27	W	... ...	... ...	... ...
28	Th	... ...	... ...	... ...
29	F	4th Div. F.A. Course at Okehampton begins (F.A. from Hilsea).	R.A. *v.* Mote Park, at the Mote.	... ...
30	S	... ...	R.A. *v.* Mote Park, at the Mote.	... ...
31	S	... ...	... ...	... ...

AUGUST.

1	M	... ...	Bank Holiday.	... ...
2	T	... ...	... ...	... ...
3	W	... ...	R.A. *v.* I.Z., at Woolwich.	... ...
4	Th	... ...	R.A. *v.* I.Z., at Woolwich.	... ...
5	F	... ...	... ...	... ...
6	S	4th Div. Course at Western Forts begins.	... ...	... ...
7	S	... ...	... ...	... ...
8	M	... ...	... ...	... ...
9	T	... ...	... ...	... ...
10	W	... ...	R.A. Woolwich *v.* Charlton Park, at Woolwich.	... ...
11	Th	... ...	... ...	... ...
12	F	... ...	... ...	... ...
13	S	... ...	R.A. Officers *v.* N.C. Officers	... ...
14	S	... ...	... ...	... ...
15	M	... ...	... ...	... ...
16	T	... ...	... ...	... ...

AUGUST.—*Continued.*

Day of the Mth.	Wk	Regimental.	Cricket, &c.	Private.
17	W	... ...	... ...	... ...
18	Th	... ...	... ...	... ...
19	F	... ...	... ...	... ...
20	S	... ...	... ...	... ...
21	S	... ...	... ...	... ...
22	M	... ...	... ...	... ...
23	T	5th Div. F.A. Course at Okehampton begins (Div. from Exeter).	... ...	... ...
24	W	... ...	... ...	... ...
25	Th	... ...	... ...	... ...
26	F	... ...	... ...	... ...
27	S	... ...	... ...	... ...
28	S	... ...	... ...	... ...
29	M	... ...	... ...	... ...
30	T	... ...	... ...	... ...
31	W	... ...	... ...	... ...

SEMPTEMBER.

1	Th	... ...	... ...	... ...
2	F	... ...	Sandown Park begins.	... ...
3	S	Long Course goes to Western Forts.	R.A. Woolwich *v.* Blackheath at Blackheath.	... ...
4	S	... ...	... ...	... ...
5	M	... ...	... ...	... ...
6	T	... ...	Doncaster begins.	... ...
7	W	... ...	St. Leger.	... ...
8	Th	... ...	... ...	... ...
9	F	... ...	... ...	... ...
10	S	... ...	... ...	... ...
11	S	... ...	... ...	... ...
12	M	Special Class Officers begins.	... ...	... ...
13	T	... ...	... ...	... ...
14	W	... ...	... ...	... ...
15	Th	... ...	... ...	... ...
16	F	Long Course leaves Western Forts.	... ...	... ...
17	S	... ...	.. ...	... ...
18	S	... ...	... ...	... ...
19	M	... ...	... ...	... ...
20	T	... ...	... ...	... ...
21	W	... ...	... ...	... ...
22	Th	... ...	... ...	... ...
23	F	... ...	... ...	... ...
24	S	... ...	... ...	... ...
25	S	... ...	... ...	... ...
26	M	... ...	... ...	... ...
27	T	... ...	Newmarket 1st October Meeting begins.	... ...
28	W	... ...	... ...	... ...
29	Th	... ...	... ...	... ...
30	F	... ...	... ...	... ...

PRÉCIS

AND

TRANSLATIONS.

"REVUE D'ARTILLERIE."

THE FIELD GUN OF THE FUTURE.

A CRITICAL EXAMINATION OF GENERAL WILLE'S RECENT WORK.

BY

GASTON[1] MOCH, *Capitaine d'artillerie.*

PRÉCIS BY

LIEUT.-COLONEL F. E. B. LORAINE, *late* R.A.

(*Continued from No. 7, Vol. XIX.*)

CAPTAIN MOCH continues his criticism in succeeding numbers of the *Revue d'Artillerie* in considerable detail and fullness, with complete knowledge of all the conditions of the problem. I regret that your space only admits of an outline of his case, but I will endeavour not to allow any important point to escape me.

He begins by pointing out that ballistic science, in its present stage, is incapable of realising the initial velocity demanded by General Wille from so light a gun. Here are the figures: a projectile weighing $14\frac{5}{16}$ lbs., muzzle velocity 2625 f.s.—resulting muzzle energy 683·66 foot tons. Again, weight of gun being only $7\frac{3}{4}$ cwt. we have the astounding figure of 88 foot tons of energy per cwt. of gun. It is to be noted that a great stride was made in this direction by the introduction of large grain powder, so much so that between the years 1873 and 1878 the relative energy of German field guns advanced from 13 to 25 foot tons per cwt. of gun. Recently muzzle velocity has been still further increased by the introduction of nitrogenous powders without unduly augmenting

[1] This officer was erroneously designated "Gustave Moch" in the previous portion of this précis.

the bore pressures. General Wille gives the result of that movement in the following table:

	Krupp Guns.				Gruson Guns.			Canet Guns
	3-inch of 27 calibres.	3-inch of 28 calibres.	3·2-inch of 26 calibres.	3·36-inch of 27 calibres.	3-inch of 30 calibres.	3·2-inch of 30 calibres.	3·28-inch (bronze) of 26 calibres.	3-inch of 32 calibres.
Weight of gun ... ... cwt.	6	8·22	8·08	9·2	7·2	9	8·73	7·18
" projectile ... lbs.	9·75	15	15·4	15·4	15·4	15·4	15·4	10·12
" charge ... ... "	·946	1·54	1·87	2·2	1·54	2·09	1·87	1·98
Size of grain ... ... m/m	2	4	5	5	4	5	4	—
Muzzle velocity ... ... f.s.	1814	1798	1837	1932	1640	1903	1739	2162
" energy ... ... ft. tons	222	336	360	398	287	387	323	328
Energy per cwt. of gun "	37	41	45	43	40	43	37	46
Max. pressure tons per sq. in.	13	14	13	15	13	13	12½	15

The relative energy of the German gun of 3·2-inch calibre which was 25 foot tons with large grain powder jumps up to 45 foot tons with Nobel powder, and after these two giant strides, namely from 13 tons to 25 tons, and from 25 to 45, we are only half way to the point General Wille hopes immediately to reach.

The reader must bear in mind that we are only dealing with field guns. Captain Moch gives a closely reasoned argument supported by figures to shew that General Wille cannot possibly attain the energy he desires without an extraordinary and impracticable increase of pressure. The General says we are only beginners in the matter of nitrogenous explosives and sees no reason why a velocity of 2625 f.s., or even more, should not be obtained without excessive pressure: and urges that hitherto the guns served with the new powders had been constructed for use with black powder. The General looks forward therefore to an improvement in powder, and would almost seem to share a common error among the uninformed that the new powders have suddenly appeared by a sort of spontaneous generation, and that another phenomenon of the same sort may any day occur. The fact is, gun-cotton and its first cousins have been studied for 40 years, and a constant effort has been made to adapt them to ordnance. It was only after long methodical research in France that "at the end of the year 1884 a general method was discovered at the *Laboratoire central des poudres et salpêtres* for the regulation of their mode of combustion and of their adaptation to a weapon of a given calibre. . . . . That substitution has resulted in giving to the artillery the most powerful explosives known at present. The use therefore of some other explosives than those selected could only result in some small improvement of detail, and a new step in advance, comparable to that just realised, could only be made by the discovery of explosives of an altogether different type from those which chemistry has now placed at our disposal."[1]

There are certainly no indications at present of a new chemical change in the direction required for the fulfilment of General Wille's conceptions.

It is possible that some advance may be made in gun manufacture by means of steel wire, realising greater power of resistance and economy in construction.

[1] *Mémorial des poudres et salpêtres*, vol. 3, pp. 11–12.

Good results may also be expected from the Mannesmann process[1] which according to General Wille has been tried in a 4·8″ gun.

But a field gun cannot be lengthened with a view to an increase of the muzzle velocity, you are at once met by the impossibility of increasing the weight, unless the material used admits of a lighter construction.

Again reduction of calibre may give some slight assistance in this direction. But General Wille claims each of these elements and goes to the very extreme limit of what is possible in each, and even beyond it.

Of the different field guns in Europe the mean length is about 7 feet 6 inches. General Wille's proposal is 9 feet 2 inches. But even that unmanageable length would not realise the ballistic conditions required. Krupp's 3·36-inch gun of 40 calibres should indeed serve rather as a warning than an encouragement. It developed a muzzle energy of 648 foot tons. Now, to attain that result with a gun of smaller calibre we must lengthen it in inverse proportion to the two calibres. General Wille demands an energy 37 foot tons in excess of the above, so he would be saddled with a gun rather over 13 feet in length or 59 calibres. Captain Moch gives a careful analysis of the relations subsisting between calibre, length, and mean and maximum pressure, by which he arrives at the above result.

The question of length brings us to that of determining the calibre. If we are again to compare the 3·36-inch Krupp with the 2·756 Wille gun we must note that their lengths will not merely be in inverse proportion to their calibres, but that that proportion will only apply to the path of the projectile, to which must be added the length of the powder chamber. The latter will of course be relatively larger in the Wille gun and even absolutely so (the charges being respectively, Wille 3 lb. 5 oz. Krupp 3 lb. 8 oz.). Indeed all weights too must be roughly proportional to the cubes of the calibres. The 3·36-inch gun weighs $20\frac{3}{4}$ cwt., the 2·756-inch should weigh 12 cwt., whereas the General only allows $7\frac{3}{4}$ cwt. The projectile which is $15\frac{1}{2}$ lbs. in the one, should be 10 lbs. in the other, the General increases it to 15 lbs. A recent Krupp 3-inch gun of 40 calibres is relatively superior to the gun chosen for comparison, but is still far from reaching the ideal results of the Gun of the Future.

As regards the metal to be chosen for guns General Wille expresses a preference for crucible steel forged under pressure, and hopes in the near future to get something better from the Mannesmann process and from chrome and nickel steel. Captain Moch on the other hand agreeing with the *Deutsche Heeres-Zeitung* looks to the Martin steel process as the most likely one for achieving progress.

General Wille treats lightly the inconvenience of his long gun on service, and contents himself by saying that it must always travel at the maximum elevation and travel over obstacles obliquely.

He is in favour of the breech closing apparatus with vertical wedge which the Gruson factory have applied to their quick-firing howitzer of 4·75-inch calibre. Captain Moch contends that no system at present is equal to the interrupted screw, which has been copied from the French both by the British and the United States Governments.

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[1] An account of Mannesmann's invention was given in the *Revue d'Artillerie*, November, 1890.

(To be continued.)

NOTES

FROM

CORRESPONDING MEMBERS.

THE subject for the Duncan Gold Medal Prize Essay, 1893, is "The Attack of a Coast Fortress."

Attention is called to the Rules for Prize Essays printed at the end of the Rules R.A.I., and Officers are asked to be careful in posting their Essay intended for competition in time to reach the Secretary on or before the 1st of April.

ANY member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

IN order to bring the already existing printed Records of the R. M. Academy up to date, it has been found that there will be a much larger amount of letter-press to be added than was at first anticipated. In consequence of this it has become necessary to raise the estimated price per copy from 12s. 6d. to 15s.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

A NEW "Kane's List" having been recently published, and progress having been made in collating relationships of R.A. Officers past and present, Officers are requested to notify to the Secretary, R.A.I., any relationship existing between them and any other officer of the same name registered in "Kane's List."

COPIES of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

THE Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

MAJOR-GENERAL F. W. Stubbs, Retired list, Royal (late Bengal) Artillery, is compiling a List of Officers who have served in the Regiment of Bengal Artillery from its first formation down to its absorption into the Imperial List.

It will consist of about 40 pages 4to, in paper cover. Price, 5s.

Any Officer who may wish to subscribe for a copy, should send his name and address to

Major-General F. W. Stubbs,
Dromiskin House,
Castlebellingham,
Ireland.

General Stubbs will be very glad to furnish any information in his power to Officers desirous of completing the records of Batteries which formerly belonged to the Bengal Artillery.

Once more the Committee have received two valuable presents for the Institution.

The first is a complete set of Campion's Plates, Illustrations of Royal Horse Artillery, presented by Lieut.-General J. R. Gibbon, C.B. These plates have long been out of print, and the publishers wrote recently to say they did not know where it would be possible to get a set.

The other present is the Regimental cape of the late Capt. Stuart Smith, R.A.; it is pierced in several places by assegais, and was brought in this condition from his saddle off the field of Isandhlwana. Major-General F. G. Ravenhill, R.A., is the kind donor of this gift.

"Field Artillery Fire," by Captain W. L. White, R.A., is complete. A reprint in pamphlet form is published at the R.A. Institution, where copies may be obtained, price 1s. each.

DUNCAN GOLD MEDAL PRIZE ESSAY, 1892.

In accordance with the vote of the General Meeting the Committee assembled on the 22nd June, 1892.

The Judges of the Essays report that the Essay bearing the motto "S'arrêter c'est de rétrograder" is worthy of the Gold Medal; that bearing the motto "Arma virumque" is worthy of the Silver Medal; and those bearing mottoes "Unhasting yet unresting work" and "Bis dat qui cito dat" are worthy of commendation and publication.

Major A. M. Murray, R.A.
is winner of
The Gold Medal,

Captain W. L. White, R.A.
is winner of
The Silver Medal,

Captain F. J. A. Trench, R.H.A.,
and
Major W. L. Davidson, R.H.A.
are the writers of the Commended Essays.

R.A. REGIMENTAL DINNER.

The Royal Artillery Regimental Dinner took place on June 10th at the Hotel Métropole, His Royal Highness, the Colonel of the Regiment, in the Chair.

164 Officers were present, as follows:—

Generals	39
Colonels	24
Lieut.-Colonels	27
Majors	35
Captains	33
Lieutenants	6

There are now 275 members of the R.A. Dinner Club.

OBITUARY.

Major F. W. Campbell, Royal Horse Artillery, died at Domel, Cashmere, on the 22nd May, 1892. Major Campbell was the only son of General Sir Frederick Campbell, K.C.B. He joined the Army, 15th December, 1871; became Captain, 1st July, 1881; and Major, 1st October, 1887. He served in the Afghan War of 1880 (medal).

Colonel J. D. Scott (retired list), Royal (late Madras) Artillery, died at 17, Norfolk Terrace, Brighton, on the 25th May, 1892, aged 77 years.

General Henry Hamilton Maxwell, who died at Rome, on the 28th May, 1892, passed out from Addiscombe with a commission in the Bengal Artillery, 10th June, 1842, and served in the Gwalior Campaign, being present at Maharajpore (bronze star). In the Sutlej Campaign he was at the battles of Moodkee, Ferozeshah, and Sobraon, where he was Deputy-Assistant Quartermaster-General, and was favourably mentioned in Lord Gough's despatches on one of those engagements (medal, with two clasps, and brevet of Major). He afterwards served with some distinction throughout the Mutiny, in the course of which he was severely wounded. He was attached to Sir W. Peel's Naval Brigade and was at the relief of Lucknow and Cawnpore. Being at home on furlough in 1853–4 he went to Bulgaria at the outbreak of the Russian War, and was present, on the Turkish side, at the battle of Oltenitza and some other military operations during that winter and spring. At a later period he was Superintendent of the Gun Foundry at Cossipore. He attained the rank of General, 31st March, 1883.

Colonel G. B. B. Holmes (retired list), Royal (Madras) Artillery, died at Whithorne House, Charlton Kings, Cheltenham, on the 1st June, 1892. He joined the Army, 11th December, 1841; became Captain, 11th December, 1856; Major, 22nd December, 1865; Lieut.-Colonel, 3rd October, 1866; and retired with the honorary rank of Colonel, 10th November, 1869.

Colonel L. G. Paget (retired list), Royal Artillery, died at Park Homer, Wimborne, Dorset, on the 5th June, 1892, aged 67 years. He joined the Royal Artillery, 20th December, 1843; became Captain, 3rd February, 1852; Major, 12th January, 1864; Lieut.-Colonel, 26th December, 1865; and hon. Colonel, 1st July, 1881. He served in India in 1857–59, and was present with Malcolm's Field Force at the defeat of a body of rebels near Nurgoond, at the storming and occupation of the Petta, and capture of the fort of Nurgoond and defeat of Tantia Topee at Chupra Barode (twice mentioned in despatches, medal).

Lieutenant F. J. Smith-Neill, R.A., died at Malta, on 8th June, 1892. He joined the Regiment 27th July, 1888, and became Lieutenant, 27th July, 1891.

CRICKET, 1892.

The R.A. Woolwich team is not having nearly so successful a season this year as last, and at present out of seven matches played has lost five and won two.

This year, as last, the two matches R.A. Woolwich *v.* R.A. Shoebury were each won by the visiting team; Shoebury made a very fine display at Woolwich on the 11th June with 318 runs for six wickets (innings declared closed), of which 2nd Lieut. W. Ellershaw made 119, and then got all Woolwich out for 120; 2nd Lieut. Currie bowled six wickets for 18 runs; the Shoebury innings was against the bowling of Lieut. Holloway, Sergt. Cochrane, and Bombr. Osmond.

It has been most difficult to get together representative Regimental teams in the first month of the season as there have been an unusual number of mobilisations, camps, and courses in different parts of the country.

The detail of matches given further on shows how well and consistently Capt. Curteis, Lieuts. DuCane and Peel have played.

Capt. Adair most unfortunately broke a finger of his right hand at Lord's on the 3rd June, and is unable to play again this season; this is a great loss to the R.A. side.

The R.E. match at Chatham was remarkable for the excellence of the bowling on each side, and there is no doubt that in Sergt. Bates the R.A. possesses a bowler of more than ordinary merit.

A Member sends the following query :—

"If a cricket ball is thrown vertically into the air has it in its fall the same velocity when it reaches the exact point from which it was thrown as it had when it started from that point, or has it less?"

The answer is :—

"The velocity with which the ball reaches the point of projection again is always *less* than the velocity with which it was thrown upwards; this effect is due to the resistance of the air."

This year as last the team to represent the Army against the Bar at Lord's was captained by Captain F. A. Curteis, R.A.; he is to be congratulated on winning the match, the more so as this is only the second time in very many years that the Army has won.

ROYAL ARTILLERY *v.* ALDERSHOT DIVISION.

PLAYED AT ALDERSHOT, 27TH AND 28TH MAY.

ALDERSHOT DIVISION.

1st Innings.		*2nd Innings.*	
Major Talbot (R.E.), c Bailey, b Cochrane	1	not out	44
Capt. Mackeson (5th D.G.), c Wynne, b Cochrane	74	b Adair	3
H. B. Trevor (14th), c Quinton, b Prescott-Decie...	36	not out	12
V. Fergusson (24th), c Prescott-Decie, b Barnes ...	47		
Capt. Lindley (R.D.), st Bailey, b Cochrane... ...	7		
" Parke (68th), c and b Cochrane	4	b Barnes	16
" Cook (Cameronians), b Cochrane	0		
R. C. Saville (68th), c and b Cochrane	0		
Capt. Mathews (5th D.G.), c DuCane, b Cochrane	12	c Barnes, b Adair	4
Capt. Raitt (R.M.L.I.), b Prescott-Decie	12		
B. W. McMahon (68th), not out	2		
Extras	11	Extras	5
Total	208	Total	84

ROYAL ARTILLERY.

1st Innings.		*2nd Innings.*	
Capt. H. R. Adair, c Talbot, b Mathews	0	b Lindley	18
E. J. R. Peel, c Mackeson, b Fergusson...	44	c Fergusson, b Raitt...	39
F. W. D. Quinton, run out...	13	c Saville, b Fergusson	73
C. Prescott-Decie, b Mathews	1	b Lindley	0
Capt. Curteis, b Mathews	1	c Parke, b Lindley	83
Sergt. Cochrane, b McMahon	9	c Cook, b Raitt...	16
J. P. DuCane, b Mathews	13	c Talbot, b Fergusson	64
Capt. Wynne, b Fergusson...	11	b Raitt	1
H. M. Barnes, c and b Mathews	0	c Fergusson, b Raitt...	0
Lieut. Palmer, not out...	21	c McMahon, b Lindley	0
Corpl. Bailey, c Mathews, b Fergusson	0	not out	0
Extras	8	Extras	25
Total	121	Total	319

ROYAL ARTILLERY *v.* GENTLEMEN OF M.C.C.

PLAYED AT LORDS, 2ND AND 3RD JUNE.

ROYAL ARTILLERY.

1st Innings.		*2nd Innings.*	
J. P. DuCane, c Lang, b Hillyard	9	c Gibbs, b Hillyard	20
E. J. R. Peel, c Pease, b Morton	12	c Gibbs, b Napier	71
Capt. F. W. Quinton, c Napier, b Hillyard	18	b Hillyard	0
" F. A. Curteis, run out	34	c Russel, b Hillyard...	54
Sergt. Cochrane, c Welman, b Morton	12	b Hillyard	4
Capt. H. R. Adair, not out	51	c Pease, b Gibson	0
A. E. J. Perkins, b Hillyard	24	b Hillyard	20
E. Prescott-Decie, b Hillyard	0	b Gibson	19
H. Atkinson, b Farmer	0	not out	4
Bombr. Butler, b Hillyard...	10	b Gibson	0
Corpl. Bailey, b Hillyard	3	b Gibson	0
Extras	13	Extras	2
Total	186	Total	194

GENTLEMEN OF M.C.C.

1st Innings.		*2nd Innings.*	
Lord Hawke, c Peel, b Butler	10	c Bailey, b Adair	74
J. S. Russel, c Adair, b Butler	0	b Cochrane...	8
A. E. Gibson, b Cochrane	13		
D. R. Napier, c Adair, b Cochrane	8	not out	17
J. A. Gibbs, c Quinton, b Cochrane...	118	not out	41
J. A. Pease, c Butler, b Cochrane	5		
G. G. Lang, c Quinton, b Adair	19		
C. H. Morton, b Butler	5		
J. H. Farmer, b Adair	34		
G. W. Hillyard, c and b Adair...	4		
F. T. Welman, not out	2		
Extras	18	Extras	7
Total	236	Total (for 2 wickets) ...	147

ROYAL ARTILLERY *v.* FREE FORESTERS.

PLAYED AT WOOLWICH, 6TH AND 7TH JUNE.

ROYAL ARTILLERY.

J. P. DuCane, c Russel, b Murdoch	106
E. J. R. Peel, c Farmer, b Sanderson	45
Capt. F. A. Curteis, b Rice	18
" J. G. E. Wynne, b Sanderson	16
A. E. J. Perkins, c Murdoch, b Sanderson	73
F. A. G. Y. Elton, b Rutter	1
Bombr. Osmond, c and b Bovill	5
Sergt. Cochrane, b Murdoch	2
Capt. A. M. C. Dale, c Murdoch, b Sanderson	14
" H. M. Campbell, st Farmer, b Sanderson	3
Bombr. Butler, not out	0
Trmptr. Findlay, absent	0
Extras	16
Total	299

FREE FORESTERS.

	1st Innings.		*2nd Innings.*
W. D. Bovill, b Butler	16	c Campbell, b Cochrane	36
J. S. Russell, c Cochrane, b Butler	0	b Findlay	27
D. R. Napier, c DuCane, b Osmond	22	c Findlay, b Cochrane	24
Capt. Rice, b Osmond	0	c Campbell, b Cochrane	0
Major L. Spens, run out	2	b Findlay	2
L. Sanderson, l b w, b Osmond	0	l b w, b Osmond	42
C. E. Murdoch, c Butler, b Osmond	3	b Osmond	0
H. Bull, run out	1	not out	23
A. E. Leatham, b Osmond	3	c Elton, b Osmond	0
C. E. Farmer, c Osmond, b Butler	4	c Osmond, b Butler	17
Capt. Elliott, not out	0	c Findlay, b Osmond	8
E. Rutter, st Campbell, b Butler	2	st Campbell, b Osmond	6
Extras	13	Extras	23
Total	66	Total	208

ROYAL ARTILLERY *v.* HOUSEHOLD BRIGADE.

PLAYED AT CHELSEA, 8TH AND 9TH JUNE.

HOUSEHOLD BRIGADE.

	1st Innings.		*2nd Innings.*
B. V. Wentworth, b Butler	82	not out	23
Sergt. Cumner, c sub., b Cochrane	14		
S. Earle, c Campbell, b Gosling	2		
H. Ruggles-Brise, c Barnes, b Butler	124		
H. W. Studd, c Osmond, b Cochrane	22	not out	70
Colonel Rowley, b Cochrane	1		
W. S. Gosling, c Campbell, b Butler	3		
J. H. R. Bailey, c Gosling, b Cochrane	24		
J. B. Bradshaw, not out	16		
H. Bathurst, b Butler	6		
Sergt. Wallis, b Butler	2		
Extras	18	Extras	14
Total	314	Total	107

ROYAL ARTILLERY.

	1st Innings.		*2nd Innings.*
E. J. R. Peel, c and b Wallis	51	c Cumner, b Gosling	17
Capt. F. A. Curteis, c Wentworth, b Studd	3	c Bailey, b Studd	30
Sergt.-Major Hunter, b Wentworth	1	c Bailey, b Studd	13
Sergt. Cochrane, b Studd	17	b Studd	53
A. E. J. Perkins, b Studd	34	c Earle, b Wentworth	38
Bombr. Osmond, b Wallis	28	c Cumner, b Gosling	17
H. M. Barnes, l b w, b Wentworth	7	b Wallis	0
Capt. H. M. Campbell, c Rowley, b Studd	29	c Wentworth, b Studd	0
S. F. Gosling, c Wentworth, b Studd	17	run out	19
Bombr. Butler, not out	0	not out	16
Trmptr. Findlay, b Stndd	0	b Studd	0
Extras	9	Extras	21
Total	196	Total	224

ROYAL ARTILLERY *v.* ROYAL ENGINEERS.

PLAYED AT CHATHAM, 17TH AND 18TH JUNE.

ROYAL ARTILLERY.

1st Innings.		*2nd Innings.*	
P. D. Hamilton, c and b Bayfield	2	b Freeland	22
A. E. J. Perkins, c and b Hedley	1	b Hedley	8
Capt. P. H. M. Dorehill, c Owen, b Hedley	3	c Hedley, b Bayfield	4
" F. W. D. Quinton, b Hedley	33	b Freeland	48
" F. A. Curteis, c Bayfield, b Hedley	15	c and b Bayfield	14
Sergt. Cochrane, b Hedley	13	b Freeland	61
Capt. H. M. Campbell, c and b Bayfield	0	c Freeland, b Hedley	6
Sergt. Bates, c Talbot, b Hedley	5	c Rawson, b Hedley	6
Capt. F. H. Crampton, c Blair, b Bayfield	3	c Rawson, b Hedley	28
Major W. L. Davidson, not out	0	c Talbot, b Bayfield	4
Bombr. Butler, b Hedley	0	not out	18
Extras	2	Extras	3
Total	77	Total	222

ROYAL ENGINEERS.

1st Innings.		*2nd Innings.*	
Major the *Hon.* M. Talbot, b Bates	11	b Bates	2
Capt. Rice, b Butler	20	b Cochrane	8
W. C. Hedley, c Cochrane, b Butler	24	b Bates	40
E. M. Blair, b Butler	7	b Bates	46
Capt. Hamilton, c Campbell, b Butler	0	c Campbell, b Cochrane	0
H. E. Freeland, b Dorehill	13	b Bates	0
G. Bigge, b Dorehill	10	b Bates	6
S. L. Owen, c Perkins, b Butler	3	c Butler, b Bates	7
Major Rawson, c Butler, b Bates	5	b Bates	0
Corpl. Bayfield, b Bates	10	not out	2
A. J. Woodroffe, not out	12	b Cochrane	0
Extras	4	Extras	12
Total	119	Total	123

ROYAL ARTILLERY *v.* ROYAL MILITARY ACADEMY.

PLAYED AT WOOLWICH, 20TH AND 21ST JUNE.

ROYAL ARTILLERY.

1st Innings.		*2nd Innings.*	
Bombr. Butler, b Macnaughten	21	b Bond	22
Capt. J. Wynne, c Bond, b Birley	17	run out	9
" F. W. D. Quinton, c Hanks, b Macnaughten	30	b Wigram	1
" F. A. Curteis, b Macnaughten	24	b Wigram	77
" P. H. Dorehill, b Wigram	9	c Macnaughten, b Bond	44
A. E. J. Perkins, c Bond, b Wigram	10	b Bond	3
Capt. A. M. C. Dale, c Cairnes, b Wigram	9	b Wigram	6
" G. Simpson, c Lamont, b Wigram	3	run out	0
H. M. Barnes, c Lamont, b Wigram	1	c and b Waters	25
Capt. H. M. Campbell, not out	1	c Cairnes, b Macnaughten	11
E. G. Waymouth, b Wigram	0	not out	16
Extras	18	Extras	30
Total	143	Total	244

ROYAL MILITARY ACADEMY.

1st Innings.		*2nd Innings.*	
H. D. Foulkes, c Quinton, b Barnes	25	c Campbell, b Barnes	11
R. A. Birley, st Campbell, b Barnes	16	c Simpson, b Dorehill	37
E. L. N. Waters, c Wynne, b Barnes	5	c Waymouth, b Butler	27
H. H. Bond, b Butler	22	b Butler	7
M. O'C. Tandy, c Butler, b Barnes	0	b Butler	27
J. F. Cairnes, b Wynne	45	b Dorehill	5
E. B. Macnaughten, c Waymouth, b Barnes	51	not out	15
C. Wigram, c and b Barnes	0	b Butler	3
C. C. Barnes, not out	9	c Butler, b Dorehill	0
J. W. F. Lamont, b Barnes	1	not out	6
J. J. Hanks, c Quinton, b Barnes	0		
Extras	16	Extras	18
Total	190	Total (8 wickets)	156

DIARY OF FIXTURES.

JULY.

Day of the Mth.	Wk.	Regimental.	Cricket, &c.	Private.
1	F	... ...	Oxford *v.* Cambridge.	... ...
2	S	... ...	Oxford *v.* Cambridge. Kempton Park 1st Summer Meeting.	... ...
3	S	... ...	... ...	... ...
4	M	3rd Division F.A. Course at Okehampton begins (F.A. from Weedon).	... ...	... ...
5	T	... ...	Stockbridge Meeting begins.	... ...
6	W	2nd Field Gunnery Course at Okehampton begins.	R.A. *v.* Harlequins, at Woolwich.	... ...
7	Th	... ...	R.A. *v.* Harlequins at Woolwich.	... ...
8	F	... ...	Eton *v.* Harrow.	... ...
9	S	3rd Div. Course Western Forts begins.	Eton *v.* Harrow.	... ...
10	S	... ...	... ...	... ...
11	M	... ...	... ...	... ...
12	T	... ...	Newmarket 2nd July Meeting begins.	... ...
13	W	... ...	R.A. *v.* Greenjackets, at Winchester.	... ...
14	Th	... ...	R.A. *v.* Greenjackets, at Winchester.	... ...
15	F	... ...	Sandown Park 2nd Summer Meeting begins.	... ...
16	S	... ...	... ...	... ...
17	S	... ...	... ...	... ...
18	M	... ...	... ...	... ...
19	T	... ...	... ...	... ...
20	W	Lecture at noon at Shoeburyness on "Electric Lights for Coast Defence," by Major Bagnold, R.E.	R.A. *v.* Queen's Club, at West Kensington.	... ...
21	Th	Lecture by Major Bagnold, R.E. (Contd.)	R.A. *v.* Queen's Club, at West Kensington.	.. ...
22	F	Lecture by Major Bagnold, R.E. (Contd.)	R.A. *v.* R.E., at Woolwich.	... ...
23	S	... ...	R.A. *v.* R.E., at Woolwich.	... ...
24	S	... ...	... ...	... ...
25	M	3rd Div. Course at Lydd begins.	... ...	... ...
26	T	... ...	Goodwood begins.	... ...
27	W	... ...	... ...	... ...
28	Th	... ...	... ...	... ...
29	F	4th Div. F.A. Course at Okehampton begins (F.A. from Hilsea).	R.A. *v.* Mote Park, at the Mote.	... ...
30	S	... ...	R.A. *v.* Mote Park, at the Mote.	... ...
31	S	... ...	... ...	... ...

FUND.

31st MARCH, 1892.

						£	s.	d.
	enditure.							
Balance i						3	5	2½
To Subscriptions						6	8	6
" Government	n £5000					18	15	0
" Rebate of In						23	10	6
						9	3	0
						0	9	0
						1	13	0

	Royal Artillery Band.			Mounted Band.					
	£	s.	d.	£	s.	d.			
nd Cases	186	5	6	34	1	5	220	6	11
ses	83	3	2	27	7	2	110	10	4
es, &c.	45	3	10	34	11	1	79	14	11
	983	4	3	334	0	0	1317	4	3
	43	5	8	20	16	8	64	2	4
	9	2	6	—			9	2	6
	16	0	0	6	0	0	22	0	0
ıts	3	19	6	0	10	6	4	10	0
	3	6	9	3	17	0	7	3	9
om and Stables	2	12	0	7	2	0	9	14	0
	26	3	0	0	3	0	26	6	0
	13	11	2	6	3	0	19	14	2
ls	1415	17	4	474	11	10			
1st March, 1892							50	13	6
TOTAL							£2004	6	10½

T.

	£	s.	d.
Subscriptions rece	50	13	6
Balance Cr	80	13	6
892			
TOTAL	£131	7	0

olonel R.A., *President.*
ain R.A., *Secretary & Treasurer.*

ROYAL ARTILLERY BAND FUND.

GENERAL CASH ACCOUNT FOR THE YEAR ENDED 31st MARCH, 1892.

Income.	£	s.	d.
Balance in hand on 31st March, 1891	97	0	11½
To Subscriptions received	1791	8	2
" Government Grant for 1891–2	100	0	0
" Rebate of Income Tax	15	17	9
TOTAL	£2004	6	10½

Expenditure.	Royal Artillery Band. £ s. d.	Mounted Band. £ s. d.	£	s.	d.
By Postal Expenses			3	5	2½
" Printing and Stationery			6	8	6
" Insurance to Michaelmas, 1892, on £5000			18	15	0
" Allowance to Clerks			23	10	6
" " Pay Sergeant			9	3	0
" Cheque Books			0	9	0
" Miscellaneous			1	13	0
" Purchase of Instruments, Slings, and Cases	186 5 6	34 1 5	220	6	11
" Purchase of Music, Stands, and Cases	83 3 2	27 7 2	110	10	4
" Repair of Instruments, Stands, Cases, &c.	45 3 10	34 11 1	79	14	11
" Pay of Master and Musicians	983 4 3	334 0 0	1317	4	3
" Clothing	43 5 8	20 16 8	64	2	4
" Lodging Allowance	9 2 6	—	9	2	6
" Arranging and Copying Music	16 0 0	6 0 0	22	0	0
" Postage and Carriage of Instruments	3 19 6	0 10 6	4	10	0
" Stationery and Printing	3 6 9	3 17 0	7	3	9
" Fuel and Articles for Practice Room and Stables	2 12 0	7 2 0	9	14	0
" Violin and other Strings	26 3 0	0 3 0	26	6	0
" Reeds and Drum-heads	13 11 2	6 3 0	19	14	2
Totals	1415 17 4	474 11 10			
Balance in hand on 31st March, 1892			50	13	6
TOTAL			£2004	6	10½

GENERAL STATEMENT.

LIABILITIES.	£	s.	d.
Subscriptions received for 1892–93	24	13	6
Balance Credit, 31st March, 1892	106	13	6
TOTAL	£131	7	0

ASSETS.	£	s.	d.
Balance in hand, as above	50	13	6
Subscriptions unpaid to 31st March, 1892	80	13	6
TOTAL	£131	7	0

H. KNOLLYS, Lieut.-Colonel R.A., ***President.***
J. C. MARSTON, Captain R.A., ***Secretary & Treasurer.***

AUGUST.

Day of the Mth.	Wk.	Regimental.	Cricket, &c.	Private.
1	M	... ...	Bank Holiday.	... ...
2	T	... ...	... ...	... ...
3	W	... ...	R.A. *v.* I.Z., at Woolwich.	... ...
4	Th	... ...	R.A. *v.* I.Z., at Woolwich.	... ...
5	F	... ...	... ...	... ...
6	S	4th Div. Course at Western Forts begins.	... ...	... ...
7	S	... ...	... ...	... ...
8	M	... ...	... ...	... ...
9	T	... ...	Kempton Park begins.	... ...
10	W	... ...	R.A. Woolwich *v.* Charlton Park, at Woolwich.	... ...
11	Th	... ...	... ...	... ...
12	F	... ...	... ...	... ...
13	S	... ...	R.A. Officers *v.* N.C. Officers	... ...
14	S	... ...	... ...	... ...
15	M	... ...	... ...	.. ...
16	T	... ...	... ...	... ...
17	W	... ...	... ...	... ...
18	Th	... ...	... ...	... ...
19	F	... ...	... ...	... ...
20	S	... ...	... ...	... ...
21	S	... ...	... ...	... ...
22	M	... ...	... ...	... ...
23	T	5th Div. F.A. Course at Okehampton begins (Div. from Exeter).	... ...	... ...
24	W	Lecture at noon at Shoeburyness on "Gunpowder and Cordite," by Lieut.-Col. F. W. J. Barker, R.A.	... ...	... ...
25	Th	Lecture by Lieut.-Col. F. W. J. Barker, R.A. (Contd.)	... ...	... ...
26	F	Lecture by Lieut.-Col. F. W. J. Barker, R.A. (Contd.)	... ...	... ...
27	S	... ...	... ...	... ...
28	S	... ...	... ...	... ...
29	M	... ...	... ...	... ...
30	T	... ...	... ...	... ...
31	W	... ...	... ...	... ...

SEPTEMBER.

1	Th	... ...	... ...	... ...
2	F	... ...	Sandown Park begins.	... ...
3	S	Long Course goes to Western Forts.	R.A. Woolwich *v.* Blackheath at Blackheath.	... ...
4	S	... ...	... ...	... ...
5	M	... ...	... ...	... ...
6	T	... ...	Doncaster begins.	... ...
7	W	... ...	St. Leger.	... ...
8	Th	... ...	... ...	... ...
9	F	... ...	... ...	... ...
10	S	... ...	... ...	... ...
11	S	... ...	... ...	... ...
12	M	Special Class Officers begins.	... ...	... ...
13	T	... ...	... ...	... ...
14	W	... ...	... ...	... ...
15	Th	... ...	... ...	... ...
16	F	Long Course leaves Western Forts.	... ...	... ...
17	S	... ...	.. ...	... ...
18	S	... ...	... ...	... ...
19	M	... ...	... ...	... ...
20	T	Lecture at noon at Shoeburyness on "Hydraulics as applied to the Service of Artillery," by G. H. Banister, Esq., Royal Carriage Department.	... ...	... ...

SEPTEMBER.—*Continued.*

Day of the Mth.	Wk.	Regimental.	Cricket.	Private.
21	W	... ...	... ...	... ...
22	Th	... ...	... ...	... ...
23	F	Lecture by G. H. Banister, Esq. (Contd.)	... ...	... ...
24	S	... ...	... ...	... ...
25	S	... ...	... ...	... ...
26	M	... ...	... ...	... ...
27	T	Lecture by G. H. Banister, Esq. (Contd.)	Newmarket 1st October Meeting begins.	... ...
28	W	... ...	... ...	... ...
29	Th	... ...	... ...	... ...
30	F	Lecture by G. H. Banister, Esq., (Contd.)	... ...	... ...

OCTOBER.

1	S	... ...	... ...	... ...
2	S	... ...	... ...	... ...
3	M	... ...	... ...	... ...
4	T	Lecture at noon at Shoeburyness on "Attack of War Vessels by Coast Forts," by Captain Orde-Browne.	... ...	... ...
5	W	... ...	... ...	... ...
6	Th	... ...	... ...	... ...
7	F	Lecture by Captain Orde-Browne. (Contd.)	Newmarket 2nd October Meeting begins.	... ..
8	S	... ...	... ...	... ...
9	S	... ...	... ...	... ...
10	M	... ...	... ...	... ...
11	T	Lecture at noon at Shoeburyness on "Employment of Iron Cupolas," by Captain Orde-Browne.	... ...	... ...
12	W	... ...	... ...	... ...
13	Th	... ...	... ...	... ...
14	F	... ...	... ...	... ...
15	S	... ...	... ...	... ...
16	S	... ...	... ...	... ...
17	M	... ...	... ...	... ...
18	T	... ...	... ...	... ...
19	W	... ...	... ...	... ...
20	Th	... ...	Sandown Park begins.	... ...
21	F	... ...	... ...	... ...
22	S	... ...	... ...	... ...
23	S	.. ...	... ...	... ...
24	M	... ...	... ...	... ...
25	T	... ...	Newmarket Houghton begins	... ...
26	W	... ...	.. ...	... ...
27	Th	... ...	... ...	... ...
28	F	... ...	... ...	... ...
29	S	... ...	... ...	... ...
30	S	... ...	... ...	... ...
31	M	... ...	... ...	... ...

PRÉCIS

AND

TRANSLATIONS.

"REVUE D'ARTILLERIE."

THE FIELD GUN OF THE FUTURE.

A CRITICAL EXAMINATION OF GENERAL WILLE'S RECENT WORK.

BY

GASTON MOCH, *Capitaine d'artillerie.*

PRÉCIS BY

Lieut.-Colonel F. E. B. Loraine, *late* R.A.

(*Continued from No. 9, Vol. XIX.*)

The ammunition of the "Gun of the Future" is to be made up in cartridges like those of quick-firers. Captain Moch points out the special advantage of this plan to Krupp whose system of obturation is defective, on the other hand he exposes the disadvantage of increased cost and weight. The cost of metal cartridges is as we know considerable. Their weight is as given in the following table :—

Calibres. (Gruson).	Weight of charge of Nobel powder in lbs.	Weight of cartridge case in lbs.	Combined weight in lbs.	Proportion (approx.)
2·28-inch ...	·507	1·599	2·106	1 : 4
" " ...	·882	2·261	3·143	1 : 3½
3 " ...	1·544	3·704	5·248	1 : 3½
3·2 " ...	2·095	3·561	5·656	1 : 2⅝
3·28 " ...	2·646	4·564	7·210	1 : 2⅔

General Wille hopes for a lighter case, thinks more especially the cases might be made thinner for nitrogenous than for black powder, and has a preference for a costly brass, rich in copper. The reader may remember (*vide* R.A.I. "Proceedings" of May, 1892) that General Wille only allowed 1 lb. 2 ozs. for the weight of his cartridge case, but to contain 3 lbs. 5 ozs. of Nobel powder it could not under existing conditions weigh less than about 6 lbs. 12 ozs. Should aluminium be ever adopted we might divide that weight by three, but the cost at the present time of such a substitution would be quite prohibitory. We must therefore measure the General's scheme by the only possible figures at the present time and accredit it with the onus of adding to the dead weight of every field battery (with 138 rounds per gun) 828 times 6 lbs. 12 ozs., or about a ton and a half. From this some deduction would have to be made for the lighter and simpler build of the ammunition boxes. But the General has made his calibre so small and his charge and projectile so large that, in view of these facts and of that of nitrogenous powder being at present less dense than black powder, his cartridge complete would have a total length of 3 feet 5 inches. How would such a cartridge fare during the turmoil of marching and fighting, and if made strictly in accordance with the General's specifications, what sort of appearance would be presented by a brass case 2½ feet long, weighing only about 18 ounces, of which the greater portion would be absorbed by the thick base, and having above it a projectile weighing over 14 lbs.? Then again, how about difficulties of extraction? Would not these be at a maximum with such ammunition as this, and be it remembered that a stuck cartridge means a disabled gun. Moreover, seeing the margin of error there would be in the length of such a cartridge, might it not happen that while the base of the cartridge was in its place the shoulder of the projectile might well be behind the commencement of the rifling, in which case the projectile would be liable to burst in the bore on receiving the check due to the tardy action of the rifling, or at any rate the action of its fuze might be disarranged. Such an event is perhaps a not very probable one, but it is all the more probable on account of the exaggerated velocity and exaggerated conditions generally of the General's scheme. Captain Moch points out what is well known to the manufacturers of quick-firing ammunition, that when a gun cartridge assumes a length incompatible with handiness in the service of the gun it is an advantage from every point of view to separate the charge and the projectile. The conclusion is therefore irresistible that a field gun with an efficient obturator would derive nothing but disadvantage from the adoption of quick-firing ammunition. General Wille's projectiles are respectively 4½ and 5 calibres long. His gun being rifled with an increasing twist he has a driving ring at the base of his projectile, and a ring at the head to ensure centering. The form of ogival head was based on the most favourable data derived from experiments made by Doctor F. August, a Professor at the Prussian School of Artillery

and Engineers at Charlottenburg[1] with the results displayed in the following table :—

		Ogive.		
		Short.	Medium.	Long.
Length of the ogive ... ... in calibres		·6662	1·0153	1·3029
Diameter of the flat head... ... ... " "		·1986	·0924	·0891
Resistance of the air to projectile.	With flat head, the surface of the ogive being generated by ... ... An arc of minimum resistance[2]	27·84	15·71	10·52
	With flat head, the surface of the ogive being generated by ... ... A straight line	29·50	17·37	11·92
	With flat head, the surface of the ogive being generated by ... ... A parabolic arc	34·40	21·24	11·87
	With flat head, the surface of the ogive being generated by ... ... An arc of a circle	37·59	21·70	15·26
	pointed, the surface of the ogive being generated by ... ... A straight line	36·03	21·57	12·84
	pointed, the surface of the ogive being generated by ... ... A parabolic arc	37·93	22·26	15·27
	pointed, the surface of the ogive being generated by ... ... An arc of a circle...	39·47	23·49	15·72
	cylindrical (maximum)	100		

Captain Moch takes this table as a theoretical confirmation of the excellence of the profile experimentally fixed for the French projectiles. The *obus à mitraille* of 3·54 inches has an ogive 4·33 inches long prolonged by 1·69 inch of fuze, total, 6·02 inches, or 1·7 calibres, and the front of the fuze forms a flat head with a diameter of ·984 inch, or ·278 calibre. German projectiles of this calibre have an ogive only 2·36 inches long of irregular form. The French Navy projectiles, which formerly had an ogival angle of 45°, have lengthened their ogives and brought the angle down to 30°, Captain Moch says, with good results.

General Wille's shrapnel is to consist of a thin steel case with a central tube and the charge at the base, the case being strengthened by longitudinal ribs. The interstices between the bullets to be filled with sulphur, or any other analogous product, unless experience should hereafter show the possibility of replacing this useless dead weight by the bursting charge. The weight of the bullets to be 42 per cent. of the weight of the projectile. (The proportion in the British service is 45 %.) But how is it proposed to give to a shrapnel of 2·756-inch calibre a weight exceeding 14 lbs.? The General's answer might be anticipated by those who remember that he is the author of the pamphlet "Wolfram-Geschosse" which made some sensation in Germany last year: it is that the bullets should be made of tungsten coated with steel. Tungsten is derived from wolfram, an ore found in conjunction with tin in Cornwall. Its specific gravity is about 17·75, that of gold being 19·3; that of the bullets coated with steel would, according to the General, be 16. Now the density of lead is only 11·4, and of hardened lead (70 lead, 15 tin, 15 antimony) about 9·5, and the ordinary weight of a shrapnel bullet is about 183 grains. The General's bullets of ·39 inch and ·43 inch diameter would weigh respectively 112 grains and 155 grains. To obtain the latter weight with hardened lead would require a bullet with a diameter of ·51 inch. The General proposes either 250 bullets of 155 grains or 340 of 112 grains. He estimates the amount of tungsten required for the supply

[1] *Archiv für Artillerie-und Ingenieur Offiziere*, Vol. 94, January, 1887.

[2] Dr. August gives the equation of the curve of minimum resistance. Captain Moch is unable to guarantee the reliability of the Professor's theoretical table given above, more especially as the Professor has not taken into consideration the action of the rarefied air in rear of the base of the projectile. Captain Moch speaks with authority on the point, as he was a member of the well-known and important Commission de Gâvre. The action of the rarefied air in rear has been demonstrated on moving trains—it is true with much lower velocities. Captain Moch attaches importance chiefly to the lengthening of the ogive.

of 500,000,000 rifle bullets and 400,000 shrapnel shell containing 100,000,000 bullets, together with the metal required for preliminary experiments, at 10,000 tons. But that already represents twice the amount of ore extracted,[1] and to it must be added the annual consumption at 5 per cent., say 500 tons of metal, or 1000 tons of ore.

Captain Moch objects to the General's provision as inadequate and quotes the following facts. The German Field Artillery expended 350,000 projectiles in 1870, and the weight of ammunition launched at Strasbourg in 1870 was three times as much as the total expenditure of the combined Prussian, Baden, and Hessian Field Batteries throughout the campaign. The General believes that 20,000 tons of ore might be extracted annually, but that, according to Captain Moch, is not the received opinion on the subject. The General's sanguine attitude as to the quantity of metal available is again observed when he discusses the question of cost. Its present market price is about £10 a cwt., the General hopes to get it for £5. However, were tungsten adopted by the various Governments, a more natural result would be an increase of the present price, owing to the supply being unequal to the demand, for the metal is only found in Cornwall and in Bohemia.

The General gives the following prices based on his assumption of the prime cost: —

1°—For 1000 rifle bullets of ·295-inch calibre, weighing 298 grains each—say

	£	s.	d.
⅓ cwt. of tungsten at £5	1	13	4
1000 nickel coatings	0	11	2
Work	0	4	0
Total...	£2	8	6

Therefore for 500,000,000 of bullets the cost would be £1,212,500.

2°—For 1000 shrapnel bullets weighing from 112 to 155 grains each, say—

	£	s.	d.
23 lbs. of tungsten at 10½d.	1	0	0
1000 steel coatings	0	7	0
Work	0	3	0
Total...	£1	10	0

Therefore, for the bullets of one field shrapnel, say 250 of them, a sum of 7s. 6d., without counting the other important accessories of that shell. A stiffish figure, more especially when based on such favourable, though uncertain, premises. And we must remember that if tungsten cannot be procured in sufficient quantity, or if Governments deem it altogether too costly for adoption, General Wille's shrapnel becomes an impossibility.

The General condemns all the time fuzes in use in Germany on account of the composition absorbing moisture and thereby burning irregularly, and is in favour of fuzes *mechanically* arranged to burst after a given time of flight. Among them he expresses a preference for the hydraulic fuze invented by Lieutenant Roy, of the Belgian Artillery, in which the burst is determined by the displacement of a given quantity of liquid, and he enumerates the following conditions which such a fuze should satisfy :—

1°—The fuze should be during transport in its place in the projectile, ready

[1] Captain Moch does not say in what period. This metal was first discovered about 100 years ago, and has been used in the manufacture of dyes and of Britannia metal and of a solution for rendering clothes uninflammable.

for use (except the regulation for time), without any danger of premature explosion.

2°—The fuze should be at zero, to admit of the projectile being used without preparation as case shot by bursting a few yards from the muzzle (Moch objects to this condition and gives reasons).

3°—The fuze should be double-action, and it should be possible to prevent the action by time in the simplest manner without any chance of error.

4°—The liquid employed should have no contact with the atmosphere.

5°—The elevation of the surrounding temperature should have no effect on the fuze except on the air enclosed with the liquid.

6°—Atmospheric conditions should at all times have the same effect on the duration of the fuze's action as on the projectile during its flight.

7°—The fuze should act without modifying the weight of the projectile during its flight; the liquid should not therefore flow out of the latter.

8°—The liquid should move in canals symmetrically situated as regards the axis of the shell to ensure equal distribution of weight round the axis.

9°—Up to the point of loading it should be possible to modify the time action of the fuze or nullify it for percussion action.

10°—It should be possible at any time to verify the correct action of the fuze.

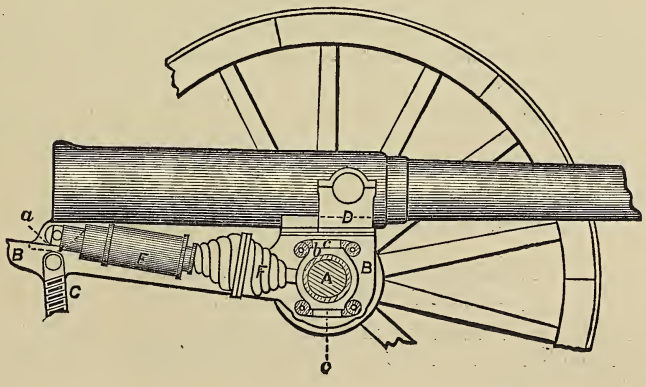
The General declares finally that he has solved all the above difficult problems, and only defers the description of his system in detail until such time as he shall have secured it by patent.

Carriages.

The General's gun carriage equipped weighs about 10½ cwt. The width between the wheels is five feet, as in existing German carriages. He has lowered the axis of the trunnions four inches, namely, from 3 feet 9 inches to 3 feet 5 inches. He has therefore lowered the centre of gravity, augmented the stability and increased the relative strength of the carriage for withstanding the shock of discharge, admitting therefore of a reduction of weight, but causing a slight diminution in the angle of the trail, viz., from 33° to 30°. The existing German gun carriage admits of a maximum elevation of 16° being given. The General's arrangement reduces this to 12°. This admits of practice exceeding 5000 yards. Beyond that, says the General, there will be time to dig a hole for the trail. The General allows nothing to be attached to the gun carriage but what is required for the service of the gun, no tools or implements except a fuze key, a tangent scale, and a practice scale, no rammer and no axletree seats, provision being made for four gunners to ride on the limber.

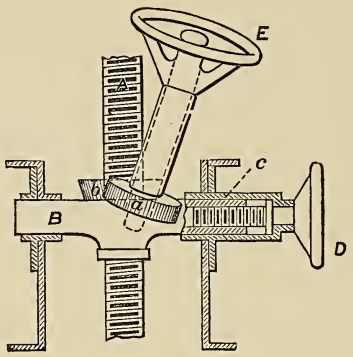
The model of the carriage is one recently patented by the Grüson Factory (Fig. 1).

Fig. 1.



A frame *B*, supported in rear by the elevating screw *C*, is attached to the axle, and is arranged by means of the collar *b* and two pivots *cc* to admit of slight lateral movements. The detail of this is shown in Fig. 2 (obtained from an article in *Die Kriegswaffen*), where the wheel *D* affects the lateral adjustment.

Fig. 2.



The trunnions rest in two cradles *D* (Fig. 1) which can recoil on the upper surface of the frame *B*. The breech is furnished with a batten *a* which slides on the rear part of the frame, and is attached to the axle by the hydraulic brake *E* and the spiral screw *F*. When the gun has recoiled it is arrested, and the spiral screw cannot bring it back to the firing position until the arrangement is released by a lever. The General proposes to abolish the trunnions and substitute the arrangement associated with heavy guns, and in addition to the hydraulic brake, &c., he advocates the brake produced in 1889 by the Gebrüder Gawron at Stettin. This brake reposes on the principle of the compressor gear long since abandoned by our Navy and the French Navy. The compression is arranged in two series of alternate circular sectors, one fixed to the axle, the other to the nave. Such an arrangement would be very liable to become useless through the accumulation of dirt and rust.

The General, who has not yet made his carriage, asserts with amusing confidence that his brake will bring the recoil down to half a metre on favourable ground, and that *incontestably* one metre will be the maximum recoil under unfavourable circumstances. Now the energy of recoil of the Wille gun can be shown by an easy calculation to be 13·86 foot-tons, whereas that of the German field gun of 1873–78, which the General selects for comparison, is only 5·3 foot-tons—ratio 1 : 2·6. If we divide these energies by the weights of the respective carriages we find in the first case 1·3 foot-tons per cwt., and in the second case ·46 foot-ton—ratio 1 : 2·8.

Captain Moch gives the recoil energy of the British 12-pr. of 7 cwt. as 2473 kg., which is equal to 8 foot-tons—or $\frac{8}{11}$ foot-ton per cwt. of carriage. The data at my command are :—

Weight of gun 7 cwt., or 356 kg.
,, ,, projectile 12 lbs., or $5\frac{5}{11}$ kg.
,, ,, charge 4 lbs., or $1\frac{9}{11}$ kg.
Muzzle velocity 1720 f.s., or 524 m.s.
$2g = 64{\cdot}4$ feet $= 19{\cdot}6$ metres.

With these figures I calculate that the recoil energy is 1593 kg., or 5·14 foot-tons. The discrepancy is so considerable that Captain Moch must have dealt with different figures.

However, whatever the real figure of recoil may be, we all know how difficult it has been to devise a carriage for this powerful little gun. How then does the General propose to control more than twice the energy *without breaking his carriage.*

On the other hand, when the General complains of all existing field carriages being too heavy, one can only wish him God speed in any useful experiments he may undertake for the purpose of making them lighter. "It is the general rule, whether in the course of experiments or of actual practice," says the General, "to rest content with the discovery of the weak points and then strengthening them. But it is rare for any one to practically ask himself *which parts are too strong*, and which might be made lighter without inconvenience. If this is not done it is obvious that some parts must be too heavy; for it would be marvellous if every part which had stood firm throughout a series of experiments was possessed of the precise measure of necessary resistance. No answer can be given to that query even if a carriage is to last for ever. In the research of extreme solidity and durability, and in the desire to provide for every accident which might occur in the course of a campaign to one carriage out of a 1000, everything is made too heavy. With this exaggerated prudence the 999 other carriages carry at all times a useless and hurtful burden, and with the final result that the accident provided for in the thousandth case will occur in a part, of which the reinforcement had never previously been shown to be requisite." Captain Moch endorses that, so does the humble writer of these extracts, who would wish, like Captain Moch, that they should be printed in capital letters.

(To be Continued).

NOTES

FROM

CORRESPONDING MEMBERS.

THE subject for the Duncan Gold Medal Prize Essay, 1893, is "The Attack of a Coast Fortress."

Attention is called to the Rules for Prize Essays printed at the end of the Rules R.A.I., and Officers are asked to be careful in posting their Essay intended for competition in time to reach the Secretary on or before the 1st of April.

ANY member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

IN order to bring the already existing printed Records of the R. M. Academy up to date, it has been found that there will be a much larger amount of letter-press to be added than was at first anticipated. In consequence of this it has become necessary to raise the estimated price per copy from 12s. 6d. to 15s.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

COPIES of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

THE Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

THE Committee have considered the question of publishing annually Addenda and Corrigenda of "Kane's List." They have gone most carefully into the matter and find that the cost would be too great to carry it out. They have determined to keep the corrections made up in the office, R.A.I., and hope in a few years' time to produce a new and improved edition of the work. As each edition costs some £300, besides the amount subscribed for copies, Members will see that the Committee cannot incur more expense on "Kane's List" in the period between two editions.

It is thought that most of the relationships between Officers registered in "Kane's List" have now been noted, and will be kept for reproduction in a new edition.

THE following works are now on sale at the R.A. Institution and will be forwarded post free at the prices noted after their titles below :—

Major-General Stubbs's "List of Officers of the Bengal Artillery," price 5s. 3d.

"Field Artillery Fire," by Captain W. L. White, R.A., price 1s. 2d.

"Notes of Lectures on Artillery in Coast Defence," by Major A. C. Hansard, R.A., price 1s. 2d.

"Ranging Note-Book," by Captain S. W. Lane, R.A., price 1s. 1d.

The list of officers who have served in the Regiment of the Bengal Artillery from its first formation down to its absorption into the Imperial List, by Major-General F. W. Stubbs, retired list, Royal (*late* Bengal) Artillery, has appeared during the past month.

It is got up in the form of "Kane's List," and contains eleven tables of officers, establishments, and distribution of Troops and Companies.

Every detail is most clearly and simply set out, and is a work that should be in the possession of all serving in the Batteries which now represent the Troops and Companies.

HALIFAX, N.S.

The officers of the Halifax Garrison Artillery (Militia) gave a mess dinner in the Halifax Hotel to Colonel Irwin (*late* R.A.), Inspector-General of Canadian Artillery, to which several officers of the R.A. were invited. Those who had not been previously honoured in this way were much surprised to find that the Halifax Garrison Artillery wear exactly the same mess dress as the Royal Artillery with no difference to enable the one to be distinguished from the other.

The arrival of the British North American Fleet every summer is one of the great events of the year at Halifax, and this year more so than ever, owing to there being a new Admiral, Sir John Hopkins, and two new ships H.M.S. *Blake* (the flagship) and H.M.S. *Magicienne*, the latter commanded by Captain Pipon, C.M.G., brother to Lieut.-Colonel Pipon, R.H.A. We feel very proud at having two men-of-war of this type on the station, being of the latest design, powerful armament, and high speed. The *Blake* came up from Bermuda, a distance of over 700 miles, in 47 hours, whereas her predecessor, the *Bellerophon*, used generally to take the best part of 10 days. Shortly after her arrival at Halifax the *Blake* went into dry dock where she was visited by thousands of persons, it being a great chance to see a vessel of this class of 9000 tons high and dry. When afloat again a party of R.A. and R.E. officers, numbering about 16, were personally conducted over her by Captain Hamilton, R.N., the Flag Captain, through whose courteous invitation a most interesting morning was spent, terminating with the firing of a torpedo from one of the submerged tubes.

On 6th June, Captain W. L. Farmar, Lieutenant W. Arthy, and a draft of 60 gunners for No. 3 Company Western Division, R.A., arrived by the Beaver Line Passenger s.s. *Lake Superior*, after a quick passage of eight and a half days from Liverpool, a much kinder fate than usually attends the unfortunate details who travel by the ordinary Allan Line steamers.

On 14th June, the G.O.C., Sir John Ross, made his annual inspection of the R.A., who were drawn up for the first time according to the new organisation, the district establishment on the right and the mobile company on the left. The General personally complimented Major Brady on the appearance, conduct, and drill of his company, which he said had been formed from three different batteries and brought into a very efficient state under somewhat adverse circumstances.

The French cruiser, *Aréthuse*, carrying the flag of Contre Amiral de Librau, commanding the Atlantic Light Division, has been spending several weeks in Halifax. The officers were entertained a great deal on shore, and freely returned the hospitality they received. They dined one night at the R.A. and R.E. Mess. The General, the C.R.A., and C.R.E., dined on board with the Admiral, and another evening five officers of the R.A. and R.E. and a similar number of the Leicestershire Regiment dined in the Ward-room. Remnants of French conversation have pervaded the atmosphere of the Mess ever since. At the dinner in the Ward-room, Major Crookenden told the story of the death of the Prince Imperial in French, which was listened to with intense interest by all the

French officers present, as he (Major Crookenden) having been on the spot at the time is in possession of all the details of the deplorable occurrence.

Halifax revels in public holidays ; besides the usual English ones we have New Year's Day, Natal Day, Dominion Day, Labour Day, and Thanksgiving Day, when all public offices are closed. The 1st July is "Dominion Day," or the anniversary of the formation of the Canadian Confederation 25 years ago, and since 1885 has been observed in precisely the same manner as the Queen's Birthday ; the Royal Standard is flown, a Royal salute of 21 guns fired, and the troops in garrison parade and fire a *feu-de-joie* round the ramparts of the Citadel.

On 9th July, the sensational news was received here by cablegram that the town of St. John's, the capital of Newfoundland, had been almost completely burnt by fire. Millions of dollars worth of property destroyed and thousands of people rendered homeless and destitute. The case was one for immediate assistance and the townspeople of Halifax acted with commendable promptness and generosity in despatching a relief steamship the same day loaded with provisions and clothing. The Military and Naval authorities have manifested the same amount of sympathy as the citizens. The General, Sir John Ross, has himself initiated a relief subscription to which every officer and soldier in the garrison will give a day's pay, and directed a great number of tents in Ordnance Store charge to be issued to shelter the houseless Newfoundlanders. They were conveyed to St. John's, together with a quantity of provisions, by the *Blake*, which steamed out of Halifax the evening of the day the news was received, and owing to her great speed was able to cover the distance of 540 miles in 27 hours.

QUETTA.

It may possibly interest the Regiment to know that at the Quetta assault-at-arms, held on the 13th, 14th, 15th, and 16th of June, by order of Major-General Sir G. White, K.C.B., K.C.I.E., V.C., a detachment of 20 Western Division, R.A. (at present commanded by Captain W. D. Burrard, R.A.), completed the regulation shift for Garrison Artillery—viz., mounting a 32-pr. S.B. of 58 cwt. from $6'' \times 9''$ on to travelling carriage, lowering into trunnion holes, and again dismounting on to the ground—in the astonishing time of $39\frac{2}{5}$th seconds. The operation was conducted by Company-Sergeant-Major Newsome ; and the time is claimed to be "a record."

CRICKET, 1892.

ROYAL ARTILLERY *v.* YORKSHIRE GENTLEMEN.

PLAYED AT WOOLWICH, 22ND AND 23RD JUNE.

ROYAL ARTILLERY.

E. J. R. Peel, b Carter	4
Sergt. Cochrane, b D. W. Lambton	6
F. W. D. Quinton, b Carter	106
Capt. F. A. Curteis, b D. W. Lambton	0
" P. H. M. Dorehill, c and b Carter	83
A. E. J. Perkins, c Landon, b D. W. Lambton	25
Sergt. Bates, not out	14
Capt. J. Wynne, c Sykes, b D. W. Lambton	0
Bombr. Butler, b Garforth	24
Capt. G. F. Herbert, b Carter	1
Corpl. Bailey, c Carter, b D. W. Lambton	16
Extras	13
Total	292

YORKSHIRE GENTLEMEN.

C. M. Seymour, b Butler	5
Hon. C. Lambton, b Bates	6
Rev. E. Firth, c Bailey, b Butler	27
W. T. Marsden, not out	10
C. W. Landon, not out	27
Hon. D. W. Lambton, C. Sykes, Capt. Saville, W. Garforth, H. C. Stamer, W. Carter	Did not bat.
Extras	9
Total (3 wickets)	84

ROYAL ARTILLERY *v.* BAND OF BROTHERS.

PLAYED AT WOOLWICH, 24TH AND 25TH JUNE.

BAND OF BROTHERS.

	1st Innings.		*2nd Innings.*
H. M. Braybrook, c and b Butler	11	b Butler	9
K. Christopherson, run out	16	b Perkins	54
Capt. Hine, b Bates	7	b Butler	18
C. Streatfeild, b Butler	1	l b w, b Perkins	27
S. Christopherson, c Butler, b Bates	41	c Curteis, b Bates	0
R. Berens, c Bailey, b Butler	3	b Bates	11
Capt. A. J. Abdy, not out	15	c Quinton, b Dorehill	54
M. Streatfeild, c Bailey, b Bates	0	b Wynne	0
Hon. H. Milles, b Dorehill	9	not out	14
Viscount Marsham, b Butler	10	c Bailey, b Butler	1
G. Style, b Bates	0	b Butler	15
Extras	12	Extras	15
Total	125	Total	218

ROYAL ARTILLERY.

1st Innings.		*2nd Innings.*	
E. J. R. Peel, c and b Streatfeild	12	c Braybrook, b Christopherson	0
Capt. P. H. M. Dorehill, c Milles, b Christopherson	63	b Braybrook	1
F. W. D. Quinton, b Christopherson	12	c K. Christopherson, b Braybrook	4
Capt. F. A. Curteis, b Christopherson	0	run out	24
A. E. J. Perkins, b Christopherson	4	c and b Christopherson	33
Capt. J. Wynne, run out	37	b Christopherson	47
Bombr. Butler, c Braybrook, b Christopherson	0	c Braybrook, b Christopherson	6
Sergt. Bates, b Braybrook	7	c Braybrook, b Christopherson	0
W. H. Perrott, b Braybrook	2	not out	7
Capt. G. F. Herbert, not out	2	b Braybrook	36
Corpl. Bailey, b Christopherson	14	c Braybrook, b Christopherson	0
Extras	19	Extras	10
Total	172	Total	168

ROYAL ARTILLERY *v.* OXFORD UNIVERSITY AUTHENTICS.

PLAYED AT WOOLWICH, 27TH JUNE.

ROYAL ARTILLERY.

F. P. Hutchinson, b Dunlop	23
Capt. J. Wynne, l b w, b Arnall-Thompson	15
" A. J. Abdy, c Arnall-Thompson, b Horner	51
" F. A. Curteis, c Leveson-Gower, b Parke	9
Major W. L. Davidson, run out	4
Capt. G. F. Herbert, c Leveson-Gower, b Arnall-Thompson	45
H. M. Barnes, run out	28
Bombr. Butler, c and b Horner	3
W. H. Perrott, not out	1
Corpl. Bailey, c Leveson-Gower, b Arnall-Thompson	1
Trumpeter Findlay, run out	3
Extras	18
Total	201

OXFORD UNIVERSITY AUTHENTICS.

H. D. Watson, b Findlay	1
E. A. Parke, b Barnes	30
H. T. S. Gedge, b Barnes	24
F. A. G. Leveson-Gower, b Butler	28
W. J. Barry, b Barnes	3
C. E. Dunlop, b Butler	22
R. H. Raphael, b Findlay	20
E. Britten-Holmes, b Barnes	11
R. Barns, c Bailey, b Barnes	18
H. T. Arnall-Thompson, c Findlay, b Wynne	28
C. E. Horner, not out	1
Extras	20
Total	206

ROYAL ARTILLERY *v.* OXFORD HARLEQUINS.

PLAYED AT WOOLWICH, 6TH AND 7TH JULY.

ROYAL ARTILLERY.

1st Innings.		*2nd Innings.*	
A. D. Kirby, c Collins, b Webbe	2	run out	3
Capt. A. J. Abdy, c M'Neill, b Webbe	6	c Hewitt, b Collins	17
F. W. D. Quinton, c Moon, b Collins	8	c Pearson, b Collins	15
Capt. F. A. Curteis, c Money-Wigram, b Collins	6	b Collins	21
" P. H. M. Dorehill, b Webbe	18	b Collins	45
" J. Wynne, c Moon, b Webbe	10	c Lawson-Smith, b Collins	2
A. E. J. Perkins, b Collins	4	b Collins	40
Sergt. Cochrane, c Money-Wigram, b Collins	0	b Collins	0
P. D. Hamilton, c Collins, b Webbe	13	b Collins	26
W. H. Perrott, not out	12	b Burge	0
Bombr. Butler, run out	0	not out	9
Extras	14	Extras	16
Total	93	Total	198

Oxford Harlequins.

1st Innings.		*2nd Innings.*	
H. S. Hewitt, b Dorehill	12	b Quinton	96
T. S. Pearson, c Curteis, b Perkins	30		
E. M. Lawson-Smith, l b w, b Dorehill	0	b Butler	17
Rev. W. Law, c substitute, b Dorehill	6	b Curteis	30
A. J. Webbe, b Hamilton	23		
D. R. Dunell, c Curteis, b Dorehill	28	b Butler	64
W. E. W. Collins, c Wynne, b Perkins	2	not out	0
H. M. Burge, c Kirby, b Perkins	0	c Hamilton, b Wynne	10
E. Money-Wigram, not out	2	b Butler	19
A. W. Moon, c Abdy, b Perkins	32		
R. J. M'Neil, b Hamilton	3	b Butler	6
Extras	12	Extras	31
Total	150	Total (for 7 wickets)	273

ROYAL ARTILLERY *v.* GREEN JACKETS.

Played at Winchester, 13th and 14th July.

Royal Artillery.

1st Innings.		*2nd Innings.*	
Capt. E. S. Cooper, c Clowes, b M'Que	5	run out	18
N. D. Foulkes, c M'Que	2	b Russell	11
J. E. Cairnes, c Lord, b M'Que	2	b Clowes	49
Capt. F. A. Curteis, b Clowes	28	c Staveley, b M'Que	16
A. E. J. Perkins, c Lord, b M'Que	2	c Russell, b Lord	0
Sergt. Cochrane, c M'Que, b Nash	0	not out	20
H. R. Palmer, b M'Que	4	b Clowes	5
H. Holman, b M'Que	21	b Russell	15
Bombr. Butler, b Blore	21	c Clowes, b M'Que	1
W. H. Perrott, b Blore	1	b Clowes	2
J. F. Lamont, b M'Que	2	b Nash	0
P. G. Godfrey-Faussett, not out	1	run out	0
Extras	6	Extras	21
Total	95	Total	158

Green Jackets.

1st Innings.		*2nd Innings.*	
Capt. C. E. Clowes, c Butler, b Cochrane	0		
Corpl. M'Que, c Lamont, b Butler	8	c Perrott, b Cooper	60
Capt. R. S. Bowen, c and b Perkins	41	not out	26
Major *Sir* G. Campbell, c Foulkes, b Butler	1		
Mr. Blore, b Perkins	37	not out	21
Capt. E. J. Dewar, c Perrott, b Butler	13		
N. Lord, b Butler	0		
Col. N. W. Wallace, b Perkins	3		
Capt. L. Russell, b Perkins	0		
C. R. Staveley, c Butler, b Perkins	13		
R. Warre, b Perkins	4		
Private Nash, not out	14		
Extras	11	Extras	2
Total	145	Total (for 1 wicket)	109

DIARY OF FIXTURES.

AUGUST.

Day of the Mth.	Wk.	Regimental.	Cricket, &c.	Private.
1	M	... ...	Bank Holiday.	... ...
2	T	... ...	... ...	... ...
3	W	... ...	R.A. *v.* I.Z., at Woolwich.	... ...
4	Th	... ...	R.A. *v.* I.Z., at Woolwich.	... ...
5	F	... ...	... ...	... ...
6	S	4th Div. Course at Western Forts begins.	... ...	... ...
7	**S**	... ...	... ...	... ...
8	M	... ...	... ...	... ...
9	T	... ...	Kempton Park begins.	... ...
10	W	... ...	R.A. Woolwich *v.* Charlton Park, at Woolwich.	... ...
11	Th	... ...	... ...	... ...
12	F	... ...	... ...	... ...
13	S	... ...	R.A. Officers *v.* N.C. Officers	... ...
14	**S**	... ...	... ...	... ...
15	M	... ...	... ...	... ...
16	T	... ...	... ...	... ...
17	W	... ...	... ...	... ...
18	Th	... ...	... ...	... ...
19	F	... ...	... ...	... ...
20	S	... ...	... ...	... ...
21	**S**	... ...	... ...	... ...
22	M	... ...	... ...	... ...
23	T	5th Div. F.A. Course at Okehampton begins (Div. from Exeter).	... ...	... ...
24	W	Lecture at noon at Shoeburyness on "Gunpowder and Cordite," by Lieut.-Col. F. W. J. Barker, R.A.	... ...	... ...
25	Th	Lecture by Lieut.-Col. F. W. J. Barker, R.A. (Contd.)	... ...	... ...
26	F	Lecture by Lieut.-Col. F. W. J. Barker, R.A. (Contd.)	... ...	... ...
27	S	... ...	... ...	... ...
28	**S**	... ...	... ...	... ...
29	M	... ...	... ...	... ...
30	T	... ...	... ...	... ...
31	W	... ...	... ...	... ...

SEPTEMBER.

1	Th	... ...	... ...	... ...
2	F	... ...	Sandown Park begins.	... ...
3	S	Long Course goes to Western Forts.	R.A. Woolwich *v.* Blackheath at Blackheath.	... ...
4	**S**	... ...	... ...	... ...
5	M	... ...	... ...	... ...
6	T	... ...	Doncaster begins.	... ...
7	W	... ...	St. Leger.	... ...
8	Th	... ...	... ...	... ...
9	F	... ...	... ...	... ...
10	S	... ...	... ...	... ...
11	**S**	... ...	... ...	... ...
12	M	Special Class Officers begins.	... ...	... ...
13	T	... ...	... ...	... ...
14	W	... ...	... ...	... ...

SEPTEMBER.—*Continued.*

Day of the Mth.	Wk.	Regimental.	Cricket, &c.	Private.
15	Th	... ...	... ...	... ...
16	F	Long Course leaves Western Forts.	... ...	... ...
17	S	... ...	.. ...	... ...
18	S	... ...	... ...	... ...
19	M	... ...	... ...	... ...
20	T	Lecture at noon at Shoeburyness on "Hydraulics as applied to the Service of Artillery," by G. H. Banister, Esq., Royal Carriage Department.	... ...	... ...
21	W	... ...	... ...	... ...
22	Th	... ...	... ...	... ...
23	F	Lecture by G. H. Banister, Esq. (Contd.)	... ...	... ...
24	S	... ...	... ...	... ...
25	S	... ...	... ...	... ...
26	M	... ...	... ...	... ...
27	T	Lecture by G. H. Banister, Esq. (Contd.)	Newmarket 1st October Meeting begins.	... ...
28	W	... ...	... ...	... ...
29	Th	... ...	... ...	... ...
30	F	Lecture by G. H. Banister, Esq., (Contd.)	... ...	... ...

OCTOBER.

1	S	... ...	... ...	... ...
2	S	... ...	... ...	... ...
3	M	... ...	... ...	... ...
4	T	Lecture at noon at Shoeburyness on "Attack of War Vessels by Coast Forts," by Captain Orde-Browne.	... ...	... ...
5	W	... ...	... ...	... ...
6	Th	... ...	... ...	... ...
7	F	Lecture by Captain Orde-Browne. (Contd.)	Newmarket 2nd October Meeting begins.	... ..
8	S	... ...	... ...	... ...
9	S	... ...	... ...	... ...
10	M	... ...	... ...	... ...
11	T	Lecture at noon at Shoeburyness on "Employment of Iron Cupolas," by Captain Orde-Browne.	... ...	... ...
12	W	... ...	... ...	... ...
13	Th	... ...	... ...	... ...
14	F	... ...	... ...	... ...
15	S	... ...	... ...	... ...
16	S	... ...	... ...	... ...
17	M	... ...	... ...	... ...
18	T	... ...	... ...	... ...
19	W	... ...	... ...	... ...
20	Th	... ...	Sandown Park begins.	... ...
21	F	... ...	... ...	... ...
22	S	... ...	... ...	... ...
23	S	.. ...	... ...	... ...
24	M	... ...	... ...	... ...
25	T	... ...	Newmarket Houghton begins	... ...
26	W	... ...	.. ...	... ...
27	Th	... ...	... ...	... ...
28	F	... ...	... ...	... ...
29	S	... ...	... ...	... ...
30	S	... ...	... ...	... ...
31	M	... ...	... ...	... ...

PRÉCIS

AND

TRANSLATIONS.

"REVUE D'ARTILLERIE."

THE FIELD GUN OF THE FUTURE.

A CRITICAL EXAMINATION OF GENERAL WILLE'S RECENT WORK.

BY

GASTON MOCH, *Capitaine d'artillerie.*

PRÉCIS BY

Lieut.-Colonel F. E. B. Loraine, *late* R.A.

(*Continued from No. 10, Vol. XIX.—Conclusion.*)

Wheels and Axles.

The May number gives a further instalment of the above interesting subject from the same able pen. General Wille, though admitting the necessity of wheels of the same diameter and pipe-box, would have them vary in strength, so as to give lighter ones to limbers and wagons than to gun carriages. He would have the lighter ones of such strength that if required under stress for a gun carriage they should be able to withstand the strain of a hundred rounds. The German service wheel with a diameter of 4 ft. $7\frac{1}{8}$ ins. weighs 192 lbs. The General, who designed it in 1873, would now replace it with two wheels of 165 lbs. and 143 lbs., and hopes that the Mannesmann process will enable him to utilise iron tubing.

Limbers.

The General would have the question of springs or elastic buffers for limbers thoroughly studied, inasmuch as the chief damage to these results from the

jolting of the ammunition. The General's long cartridges would of course lie flat in the limber boxes. He preserves as a secret his method for enabling them to lie securely without being jolted. The German limber weighs 17½ cwt., the General's would be 15 7/10 cwt. with thirty rounds, or 14 7/10 cwt. with twenty-four rounds for horse artillery. The General's wagon is lighter than his gun, an example that might well be followed to prevent wagons, as was so frequently the case, being a kind of shot tied to your heels, to use Colonel Langlois's emphatic language.[1] The General in discussing such weights treats them from the point of view of draught. Such matter on paper seems to me of small profit—its theoretic value is almost nil. Captain Moch then invites our attention to the 6-inch mortar wagon and field wagon, 1889, of the Russian service. These wagons consist each of two similar half-wagons attached by a movable perch, so that a battery consists of six limbers and 18 half-wagons. The half-wagon is rather heavier than a limber, as it carries four or five more rounds so as to maintain the figure of total rounds, but is otherwise similar and would replace an empty limber when required. The total rounds carried are 6 × 30, added to 18 × 35, or 810. It would be easy however to make the half-wagons and the limbers identical, with a wonderful simplicity and uniformity of organisation, and better still, in the writer's opinion, if each half-wagon or limber (the name of the thing is immaterial) other than those attached to the guns were independent with a single pair of horses, while spare stores were carried in general service wagons. General Wille would abolish the forge as carriage, and would carry a small portable forge on a general service wagon. In the German service this latter wagon weighs a ton; the General would bring it down 2 cwt. by lightening the wheels and axles. As to the stuff with which they are laden the General delivers his soul in the following terms: "As on the forge, so in these we stow away stores, tools, gear and raw material in such large quantities, as if a battery in its bivouac were a miniature factory, or as if we wanted to make war in Siberia or in Africa. . . . . I fear greatly that a large part of those precious goods, transported with infinite trouble, would be of no practical value, but would serve no other purpose than to swell out reports and returns."

THE GUNS OF TO-MORROW.

Proposals of the "Militär-Wochenblatt."

The *Militär-Wochenblatt*, not content with criticising General Wille, makes the following counter proposals:—

1°—The gun not to exceed about 8½ cwt.

2°—Obtain maximum effect with a pressure not exceeding 2200 atmospheres (about 14 tons per square inch).

3°—Total length not to exceed 7½ feet.

4°—Obtain a muzzle energy of 48 foot tons per cwt. of gun, or a total energy of 408 foot tons with an 8½ cwt. gun. The muzzle velocity will then be 2024, 1945 or 1883 foot seconds with projectiles weighing respectively 14·3, 15·4, or 16·5 lbs. The author decides for the heaviest projectile to secure the maximum number of shrapnel bullets without having recourse to tungsten, and for all projectiles of uniform weight. As for calibre, if it be true that its diminution leads to increased transverse density in the projectile, it also leads to increased pressure and as a consequence a thicker projectile with a less satisfactory interior organisation. Calculation gives 8cm (3·15 ins.) as satisfying the best conditions, but the resultant energy is then only 59 per cent. of that theoretically demanded by General Wille. The *Wochenblatt* gun has an energy of recoil of 8·35 foot tons, consequently the author cannot see his way to lightening the gun carriage. The

[1] With the British 12-pr. the wagon is 2 cwt. lighter than the gun.

following table, to be read with due reserve, gives the figures of this gun compared with others.

	Gun.			
	German.	French. 80mm.	French. 90mm.	*Wochenblatt.*
Muzzle velocity ... ... f.s.	1450	1526	1417	1870
Remaining velocity at 5000m f.s.	623	771	741	869
Muzzle energy ... ... f.t.	226	223	267	402
Energy at 5000m ... ... f.t.	42	57	73	87
Angle of elevation for 5000m ...	19° 30′	13° 32′	15° 27′	9° 26′
Angle of descent for 5000m ...	30° 56′	20° 39′	23° 4′	15° 0′

These calculations, says the *Wochenblatt*, are based on the advantageous form (long ogive) of French projectiles. The figures of the German and *Wochenblatt* guns would be less favourable with the German form of shell. The author notes however that the gun he recommends is more powerful than the French 90mm while weighing 26% less, and throwing a projectile 14% less. On the other hand he admits that practice may not entirely bear out the theory of his gun, and that extreme flatness of trajectory has its drawbacks as well as its advantages.

As compared with General Wille's gun, the *Wochenblatt* weapon has a calibre 14% larger, a projectile 15% heavier, a muzzle velocity 29% less, and a muzzle energy 41% less. However at 3000 metres the energy of the General's gun is only 7·75 foot-tons in excess of the other, while at 4000 metres the *Wochenblatt* gun leads with an excess over its rival of 3 foot-tons. While the General's gun is "in nubibus" the *Wochenblatt* gun might be built to-morrow.

Conclusion.

Captain Moch, after carefully going over the ground again, comes to the conclusion that the material of the French field artillery is much more powerful than that of the other great Powers, and that for them at any rate there is at present no occasion to incur a large expenditure in reconstruction or even experiment. He does not wish his country to go to sleep and disregard the incessant march of science, but to regard the practical point of keeping their equipment up to the mark of all possible improvement, as distinguished from that which is based on uncertain and dangerous theories.

"MILITÄR WOCHENBLATT."

29th JUNE, 1892.

COMPARISON OF THE MOST IMPORTANT REGULATIONS OF FOUR CONTINENTAL POWERS AS REGARDS THE ATTACK.

TRANSLATED BY

COLONEL LONSDALE HALE, LATE R.E.

GERMANY.

THE German Regulations make a distinction between the "*Begegnungsgefecht*" (improvised fight) and that on a prepared position; in the latter case the attack being in conformity with a pre-arranged plan, and preceded by a deployment; in the former case the fight is developed from the march, the deployment of the main body being effected under the protection of the advanced guard.

The attack is divided into three parts—

1. Troops are thrown forward to open fire on the enemy as near to his position as the ground allows.

2. Strong swarms of shooters work their way up to these troops and endeavour to conquer the enemy by fire. The only prospect of success lies in obtaining this superiority of fire.

3. When this superiority is attained, the shooting line, aided by supporting troops arrived close at hand, advance to storm the position. This order will, as a rule, come from the highest commander, but the impulse (*anstoss*) for the attack may also proceed from the shooting line.

The retreating enemy is pursued with fire after the capture of his position.

An enveloping attack is recommended as conducive to success; but this is not to proceed from the developed fighting line but must be arranged for beforehand.

RUSSIA.

The attack is divided into—

1. Advance.
2. Attack.

From the deployment (*Entwicklung der Gefechtsordnung*)—about 2000 paces from the enemy—to the entry within the zone of strong hostile rifle fire—800 paces from the enemy—the advance is continued along the whole front in quick time. From this point the attack is the object of all forward movements. The command has ascertained the position of the enemy, arranged the plan of attack, strengthened the shooting line, and given to all the troops the right direction in which to attack.

The advance is by rushes either of the whole line or by portions of the same. The last firing position from which the attack is prepared by fire is from 300–150 paces from the enemy. From this point the attack is with the bayonet. Reserves advance over open ground in line with open files. When the shooting line is in its last position (300–150) the reserves may not be further than 200 paces in rear of it. The reinforcement of the shooting line is carried out before advancing to the attack, at 800 paces from the enemy.

AUSTRIA.

The Superior Commander draws up a plan of combat. The offensive must always be taken. If possible the attack must be enveloping, and only frontal when a surprise or approach under cover is possible, or if any other direction for the attack is not available.

Under the protection of a preparatory fight follows the development of the main body next to the advancing line; later on the main body is pushed forward to those points from which the attack proper will commence, and at the decisive advance moves direct forward.

The principle is to arrive quickly as near as possible to the enemy. At long rifle range, 2000–1000 paces, the advance is by the whole line. At medium ranges, 1000–500 paces, simultaneous rushes by whole companies; from 500 paces is carried out the decisive attack, after previous shattering of the enemy by fire. There must be a constant pressing forward everywhere. The order for the attack will, as a rule, come from the Supreme Commander (*Signal-Storm*), but the impulse for it may be given from the shooting line. At the moment before the decisive attack is made (*Beim Abbruch des Gefechts vor der Entscheidung*) the reserves are to be sent back to take up on the flank a rallying position, but only there where obstinate resistance is intended.

FRANCE.

The attack alone can obtain decisive results.

Formations for the advance are to be chosen suited to the ground, and screened from the enemy's view. No premature deployment; only when the enemy's fire renders it necessary will a shooting line be extended, sufficing for the opening of the fight. If the hostile fire is opened, fire will be opened in reply at 700 metres, otherwise as near the enemy as possible. The further advance follows from position to position, the intermixture of commands being avoided; the supports come up on the flanks and in the intervals. The supports gradually near the shooting line. As soon as fire reinforcements are necessary half-sections or sections are sent forward in the intervals or on the flanks. This insertion of reinforcements gives the impulse to a further advance.

When the advance has arrived at 400 metres, the action is carried on with the aid of the reserves, the advance being by 50 metre rushes of companies or in echelon. Those shooters left in rear may not fire if there is not interval available. At 250–200 metres bayonets are fixed. The shooters increase the fire and direct it on to the point to be assaulted. The advance of the reserve to the assault is the signal for the storming, if the enemy has not yet given way. To the "storm pace" soon succeeds the "double," with the cry "*en avant à la baionnette*" all throw themselves on the enemy. This is conducted with the greatest energy.

The pursuit is carried on by fire. In case of failure of the attack, company leaders rally their companies quickly and endeavour to renew the attack, for the advance is always preferable to the destructive retreat.

COMPARISON.

In all four the attack is in three parts. The Russian primary division is of two, but the attack portion subsequently becomes two, making three.

The first is the advance towards the position up to the opening of fire.

The second is the carrying through the fire fight and advance up to the storming.

The third is the bayonet attack.

The four systems agree that the first stage is to be carried out with weak advanced troops; the extended shooters going forward in one body quickly as near to the enemy as possible. The Germans do not give any distance to which this first advance should be made nor where it commences. The Russians and Austrians give 2000 paces as the commencement. The French make the formation of a shooting line dependent on the enemy's fire.

The Russians consider up to 800 paces, the Austrians 1000 paces, the French 700 metres (900 paces) as the distance from the enemy to be attained by the first general advance.

For the fire fight the Germans give strong swarms of shooters working their way marching or by rushes, and seeking to gain superiority of fire. The Russians and Austrians order rushes, the former to 300–150 paces, the latter to 500 paces, the former with the whole or parts of the shooting line, the latter by whole companies.

The French by rushes, company or echelon up to 50 metres from the enemy; no mixing up. The Russians reinforce the shooting line at 800 paces before the commencement of the attack. The French accept 400 metres as the distance for the entry of the supports. The Germans and Austrians are silent on the subject. All four demand the shattering of the enemy by fire before the commencement of the storming.

All four have the advance to the storm carried out by the shooting line aided by the reserves. The Germans bring their reserves for the purpose close up. The Russians at most 200 paces from the shooters.

With the Russians the bayonet attack commences from the last firing position, 300–150 paces; the French 250–200 metres from the enemy; the Austrians say the attack proper commences at 500 paces; the Germans give no distance.

Both Germans and Austrians leave the order for the decisive assault to the highest leader, or through impulses from the shooting line. The Russian and French are silent on the matter. All four pursue the enemy with fire; the French provides for a renewal of a failed attack.

It is to be noted that the German Regulations order the deployment before the fight; whilst the Austrian Regulations order the development of the main body, and, later on, its movement to those points from which the attack proper is to commence.

NOTES

FROM

CORRESPONDING MEMBERS.

The subject for the Duncan Gold Medal Prize Essay, 1893, is "The Attack of a Coast Fortress."

Attention is called to the Rules for Prize Essays printed at the end of the Rules R.A.I., and Officers are asked to be careful in posting their Essay intended for competition in time to reach the Secretary on or before the 1st of April.

Any member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

In order to bring the already existing printed Records of the R. M. Academy up to date, it has been found that there will be a much larger amount of letter-press to be added than was at first anticipated. In consequence of this it has become necessary to raise the estimated price per copy from 12s. 6d. to 15s.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

Copies of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

The Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

The following works are now on sale at the R.A. Institution and will be forwarded post free at the prices noted after their titles below :—

Major-General Stubbs's "List of Officers of the Bengal Artillery," price 5s. 3d.

"Field Artillery Fire," by Captain W. L. White, R.A., price 1s. 2d.

"Notes of Lectures on Artillery in Coast Defence," by Major A. C. Hansard, R.A., price 1s. 2d.

"Ranging Note-Book," by Captain S. W. Lane, R.A., price 1s. 1d.

The Mess Committee R.A. Mess, The Castle, Dover, will be very glad to receive as gifts or on loan from officers such sporting trophies as they may wish to be carefully looked after and well placed for exhibition.

Many officers serving abroad have difficulty in finding a home for their trophies, and will do well to avail themselves of this offer of the Dover Mess Committee.

The following is part of a letter from the D.-A.-G., R.A., and will explain why the names of certain officers have recently disappeared from the R.A. Regimental Lists :—"It having been decided that such officers of the R.A., above the rank of Major, who have been selected, or may hereafter be selected, for continuous service with the Indian Ordnance Department, shall cease to belong to the Regiment so far as further regimental employment is concerned, and will con-

sequently be struck out of the Regimental Lists and returns, H.R.H. the Commander-in-Chief has decided that such officers may have the privilege of continuing to belong to such of the Regimental Institutions (Marriage Society, R.A. Institution, &c.) as they may have been subscribing to prior to their selection for such continuous Indian service."

LEFROY MEDAL.

THE Lefroy Medal was founded in 1891 to perpetuate the memory of General Sir J. H. Lefroy, K.C.M.G., C.B., R.A., &c., &c.

The proceeds of a sum of money, vested in Trustees, are devoted to provide a gold medal for the officer passing first out of the Senior Class Artillery College. The class which closed in March, 1892, was the first to which the medal was granted, and the following is an account of its presentation.

After the business of the R.A. Institution was finished at the Annual General Meeting on 10th June, General R. J. Hay, C.B., said :—" Gentlemen, I have the pleasure of bringing to your notice the presentation of the Lefroy Medal to Lieutenant J. H. Mansell, R.A. In the first instance, I would express the regret of the Director-General of Military Education at not being here to-day to present this medal, which he considers is about the highest distinction that an officer undergoing any course in the Regiment can obtain. Lieutenant Mansell has passed out of the Artillery College with the greatest distinction. All I have to do, Lieutenant Mansell, is to present it to you, and congratulate you on having won it ; and I hope you will remember that it is not for your own credit only you obtain this distinction, but for the credit of the whole Regiment." (Applause.)

R.A. CHARITIES.

THE Committee R.A. Regimental Charities wish it to be known that there is in the county of Forfarshire a Patriotic Fund out of which pensions are granted to soldiers' widows in necessitous circumstances who are natives or connected with the county ; Lieut.-Colonel A. J. Rait, C.B., *late* R.A., will be happy to use his influence to obtain any pension which may from time to time become vacant for the widow of a soldier R.A. duly qualified as above. Any communication on this subject should be made to the Hon. Sec. R.A. Regimental Charities, Woolwich.

STAFF COLLEGE ENTRANCE EXAMINATION, 1893.

Army Order 143 of 1892 :—

1. At the examination for admission to the Staff College, to be held in May, 1893, questions in Military History will be set as follows :—

(*a.*) On Parts I.—V. of the "Operations of War," excluding the details of the movements recorded in Chapter iii., Part V.

(*b.*) On the Physical Geography of France, the German Empire, Holland, and Belgium.

Maps in good atlases and articles in geographical dictionaries will furnish all the information necessary for answering questions under this head. A knowledge of the details of the ramifications of mountain systems, or of small tributary river basins, will not be required.

(*c.*) On the Campaign of the first German Army in the North of France, from the advance of the Army to the Somme, 16th November, 1870.

Only the period from the 1st January, 1871, need be studied in detail. Questions on the previous part of the Campaign will be confined to the main incidents, the principal movements, and their object.

Sketch Maps of the Theatre of War and of the Battlefield of St. Quentin will be supplied at the examination to the candidates.

The Campaign is narrated in the under-mentioned sections of Major Clarke's authorised translation of the Franco-German War, 1870–1, Sec. XIV., price 4/-; Sec. XV., price 2/6; Sec. XVII., price 3/-. The analytical index (price 1/6) to the translation, compiled by Colonel Lonsdale Hale, will be found useful.

COURSE OF MILITARY HISTORY.—STAFF COLLEGE, 1893.

I. Before taking up HAMLEY'S OPERATIONS OF WAR (which assumes considerable knowledge on the part of the Student), a general sketch of European Military History should be read. Either of the following would be found sufficient :—

(*a.*) "MODERN MILITARY HISTORY," by Dr. Maguire.

(*b.*) The Campaigns of 1796–1806, and 1813–15, as described in the "EPITOME OF ALISON'S HISTORY OF EUROPE."

(*c.*) A CENTURY OF CONTINENTAL HISTORY, 1780–1880, by J. H. Rose, with 3 maps, and 5 plans of battles in the text.

II. A good general Map is THE BASINS OF THE RHINE AND DANUBE, with coloured Contours, Forts, &c., &c.

An excellent small Military Atlas is the CARTES CROQUIS, used at St. Cyr.

Niox's GÉOGRAPHIE MILITAIRE.

Marga's GÉOGRAPHIE MILITAIRE.

III. For a general knowledge of the Operations in France after Sedan, a good Summary will be found in THE PROCEEDINGS OF THE ROYAL ARTILLERY INSTITUTION, No. 10, Vol. 18.

In the absence of larger works, it will be most useful to read :—"THE THEATRE OF WAR OF THE RHINE AND DANUBE." "GERMANY," by S. Baring Gould. "FRANCE," by M. Roberts.

The Sections of the translation of the official account of the FRANCO-GERMAN WAR, mentioned in the G.O.

MAP OF THE NATURAL FEATURES OF FRANCE AND GERMANY, between Paris and Berlin. A useful map for the study of the Franco-German Campaign, 1870–71.

INDIA.

ALTHOUGH the General Orders announcing the result of the shooting for the annual prize given by the Inspector-General of Artillery in India were published in June, 1892, it is perhaps not too late to call attention to the wonderful advance of the shooting, 1891–92 (called 1892) on that of previous years, and to compare it in a few points with that of 1890–91 (called 1891).

The conditions of 1891, which were not sufficiently varied in 1892 to affect the comparison, were as follows:—

All batteries of Horse and Field Artillery in India to compete, except those which arrived from England in relief.

Target—Six wooden targets each ($6' \times 6' \times \frac{1}{2}''$) in line.

Ranges—Unknown at two positions with common and shrapnel shell, but to be within the following limits:—

	1st Position between	2nd Position between
12-pr. B.L.	3600 and 2900 yds.	2800 and 1800 yds.
9-pr. R.M.L.	2800 and 2300 yds.	1800 and 1400 yds. (2200 and 1500 yards in 1892).

3rd Position with case shot—About 300 yards.

The battery to be drawn up 5 miles from the target, the position of which is unknown to the Commanding Officer, advance at a trot $2\frac{1}{2}$ to 3 miles under the guidance of a Staff or other officer, halt and prepare for action, then advance to the first position approximately pointed out by the General or other officer commanding at the station, come into action and fire a total of 18 rounds.

After replenishing ammunition, repairing targets, &c., the battery to advance at a trot to the second position, to be pointed out as before, and proceed as at the first position. Then advance (Horse Artillery at a gallop, Field Batteries at a trot) to 300 yards from the target, halt and fire six rounds of case shot.

Ammunition—Common and shrapnel, 36 rounds in all, proportion of each and nature of fuze being left to the Commanding Officer. Case shot, 6 rounds. Lodges and throughs only counted.

The number of hits, time taken, the number of bullets in shrapnel of 12-pr. B.L. compared to 9-pr. R.M.L. (viz., about 4 to 3), and the manner in which the practice was carried out are considered in awarding the prize.

The following remarks are taken from the General Orders, Simla, 4th June, 1892:—

"The Commander-in-Chief is much gratified at the very satisfactory advance made on previous years. Ten batteries have exceeded the highest score of last year.[1]

His Excellency also notes with satisfaction that the 12-prs. are at last taking their proper place on the list (due in part to the use of service ammunition, but also to improvement in fire discipline), and that there has been a very decided advance in the shooting of the Royal Horse Artillery.

In point of time taken in action, there is also an improvement (twenty-one batteries being under 20 minutes against 8 last year), but slowness is now the chief fault. Lord Roberts considers that with proper training the time taken in action at the three positions should not exceed 15 minutes, and every exertion should be made to attain this end."

In 1891 there were only five 12-prs. in the first 20 batteries.

In 1892 the first nine are 12-prs., and there are only seven 9-prs. in the first 20; but on the other hand nearly 20 per cent. more batteries are equipped with the 12-pr. gun in 1892 than in 1891.

In 1891 the quickest time was 16 mins. 4 secs. taken by a battery placed last but five on the list; in 1892 a battery much higher on the list, consequently making better shooting, took only 12 mins. 2 secs.

In 1891 the average time of the first five batteries on the list was 25 mins. 39 secs.; in 1892 it is 20 mins. 15 secs., but, as noted above, the Commander-

[1] Irrespective of the number of hits by case shot, which this year have not been taken into account.

in-Chief does not consider this time nearly quick enough.

The changes of place of batteries on the two lists are very great.

The winning battery in 1892 was 30th in 1891, while the 2nd battery in 1892 has gone up to that position from 46th, or last but two in 1891.

The 3rd battery of 1892 was 17th in 1891.
„ 4th „ „ „ 36th „ „
„ 5th „ „ „ 38th „ „

But the 7th and 8th of 1892 were 5th and 6th respectively in 1891. Were it not for the consistent position of these two batteries it would seem as if the element of chance has its place in the competition.

The following are the detailed results of the shooting of the first five batteries on the 1892 list. The criticisms in the column of remarks are omitted.

Battery.	Name of Battery Commander.	Hits.				Total Time in Action.		Equipment.	Remarks
		First position.	Second position.	Total.	Third position.	Minutes.	Seconds.		
65th Field ...	Capt. E. F. Nelson	267	356	623	81	21	28	12-pr. B.L.	Winner.
A. Royal Horse Artillery. ...	Major A. E. Duthy...	77	446	523	59	21	17	"	
Q. Royal Horse Artillery. ...	Major Hon. F. W. Shore	274	133	407	95	19	30	"	
36th Field ...	Major J. D. Douglas	111	275	386	93	18	16	"	
B. Royal Horse Artillery. ...	Major F. W. Campbell	258	120	378	67	20	34	"	

OBITUARY.

Lieutenant E. A. Routh, who died at Cambridge, on 1st July, 1892, joined the Regiment as a Second Lieutenant, on 23rd July, 1887, became Lieutenant, 23rd July, 1890, was placed on temporary half-pay owing to ill-health on 24th November, 1891.

CRICKET, 1892.

ROYAL ARTILLERY *v.* QUEEN'S CLUB.

PLAYED AT WEST KENSINGTON, 20TH AND 21ST JULY.

QUEEN'S CLUB.

1st Innings.		*2nd Innings.*	
B. V. Wentworth, c Cochrane, b Butler	18	c DuCane, b Abdy	19
A. Menzies, b Butler	1		
F. H. Browning, b Cochrane	44	not out	18
R. Manders, c and b Cooper	16	c Curteis, b Abdy	18
Lord Ernest Hamilton, b Cooper	92	c sub, b Abdy	3
G. Batts-Mills, b Cooper	3		
E. M. Bovill, run out	0		
S. D. A. Corbett, b Cochrane	9	st Bailey, b Davidson	21
D. J. Tata, l b w, b Cooper	4	c Bailey, b Cooper	2
Jones, not out	21		
Winderbanks, b Cooper	5		
Extras	13	Extras	5
Total	226	Total (for 5 wickets)	86

ROYAL ARTILLERY.

1st Innings.		*2nd Innings.*	
Capt. H. E. Stanton, c Bovil, b Wentworth	42	l b w, b Wentworth	34
" E. S. Cooper, c Bovill, b Winderbanks	21	run out	16
Sergt. Cochrane, b Jones	63	c and b Winderbanks	37
Capt. Curteis, c Hamilton, b Wentworth	27	b Bovill	32
J. P. DuCane, b Wentworth	8	c Winderbanks, b Browning	15
Major Davidson, c Hamilton, b Browning	7	b Browning	3
H. D. White-Thomson, c Browning, b Wentworth	43	st Menzies, b Corbett	75
Capt. Abdy, c Mills, b Wentworth	10	b Browning	26
Bombr. Butler, b Wentworth	3	b Browning	15
W. H. Perrott, b Browning	17	b Browning	1
Corpl. Bailey, not out	15	not out	1
Extras	27	Extras	19
Total	283	Total	274

ROYAL ARTILLERY *v.* ROYAL ENGINEERS.

PLAYED AT WOOLWICH, 22ND AND 23RD JULY.

ROYAL ENGINEERS.

Major Young, b Butler	33
Capt. Rice, b Cochrane	5
W. C. Hedley, b Butler	12
E. M. Blair, b Butler	69
Capt. Maclagan, b Perkins	5
H. E. Freeland, not out	86
C. W. Gwynne, b Dorehill	7
A. E. Turner, b Butler	0
A. J. Woodroffe, b Perkins	15
F. G. Guggisberg, b Butler	3
Corpl. Bayfield, b Butler	3
Extras	20
Total	258

ROYAL ARTILLERY.

1st Innings.		*2nd Innings.*	
Capt. E. S. Cooper, b Bayfield	6	b Hedley	6
J. P. DuCane, c Woodroffe, b Hedley	26	b Hedley	13
Capt. P. H. M. Dorehill, c Guggisberg, b Hedley	3	b Hedley	0
F. W. D. Quinton, b Hedley	50	c and b Hedley	7
Capt. F. A. Curteis, l b w, b Bayfield	10	c Bayfield, b Freeland	18
Sergt. Cochrane, c Bayfield, b Hedley	0	b Hedley	31
H. D. White-Thomson, c Maclagan, b Hedley	1	b Hedley	8
A. E. J. Perkins, c Blair, b Hedley	0	b Bayfield	3
Capt. J. Wynne, c Guggisberg, b Hedley	1	not out	0
" A. J. Abdy, run out	13	c Guggisberg, b Hedley	2
Bombr. Butler, not out	14	b Hedley	9
Extras	13	Extras	6
Total	137	Total	103

ROYAL ARTILLERY *v.* MOTE PARK.

PLAYED AT MOTE PARK, 29TH AND 30TH JULY.

ROYAL ARTILLERY.

1st Innings.		*2nd Innings.*	
Capt. P. H. M. Dorehill, c Atkins, b Wright	60	l b w, b A. J. Thornton	60
" A. J. Abdy, b A. J. Thornton	4	l b w, b A. J. Thornton	1
Sergt. Cochrane, c Hinde, b Thornton	0	b Prentis	1
Capt. F. A. Curteis, c Hickmott, b Thornton	17	b Prentis	51
J. W. D. Adam, b A. J. Thornton	40	c Wright, b A. J. Thornton	10
H. D. White-Thomson, b Thornton	8	c A. J. Thornton, b Prentis	5
H. M. Barnes, b Thornton	5	c M'Alpine, b Prentis	1
W. A. Boulnois, b Thornton	1	not out	1
Bombr. Butler, c Prentis, b Wright	1	c M'Alpine, b Prentis	0
Sergt. Young, not out	5	c R. T. Thornton, b A. J. Thornton	2
H. L. Kirke, c A. J. Thornton, b Wright	3	absent	0
Extras	9	Extras	8
Total	153	Total	140

MOTE PARK.

F. M. Atkins, b Butler	33
E. Hickmott, b Curteis	182
Rev. R. T. Thornton, c Curteis, b Butler	72
Major L. T. Spens, b Dorehill	19
W. Wright, not out	63
H. Prentis, not out	12
A. J. Thornton, Capt. Hinde, K. M'Alpine, G. Knight, G. M. Style	Did not bat.
Extras	21
Total	(4 wickets)*402

* Innings declared closed.

ROYAL ARTILLERY *v.* I ZINGARI.

PLAYED AT WOOLWICH, 3RD AND 4TH AUGUST.

ROYAL ARTILLERY.

1st Innings.		*2nd Innings.*	
J. P. DuCane, c Cooper-Key, b Cottrell	2	c Vernon, b Cattley	34
Capt. F. A. Curteis, b H. Mordaunt	90	b Cattley	19
H. D. White-Thomson, c Cooper-Key, b E. Mordaunt	62	c Cottrell, b H. Mordaunt	31
A. E. J. Perkins, c E. C. Mordaunt, b H. Mordaunt	94	c H. Mordaunt, b Cattley	52
E. L. Tomkins, l b w, b E. C. Mordaunt	8	b E. C. Mordaunt	3
F. A. Elton, run out	9	c Cottrell, b E. C. Mordaunt	8
Major W. L. Davidson, c Vernon, b H. Mordaunt	0	c Paravicini, b Cattley	1
Bombr. Butler, c E. C. Mordaunt, b H. Mordaunt	11	b E. C. Mordaunt	2
Capt. A. J. Abdy, b H. Mordaunt	0	c and b Cattley	1
W. A. Boulnois, c Cottrell, b E. C. Mordaunt	2	c Spens, b Cattley	3
E. G. Waymouth, c and b E. C. Mordaunt	16	st Wynyard, b Cattley	1
Trmptr. Findlay, not out	0	not out	3
Extras	7	Extras	15
Total	301	Total	173

I ZINGARI.

1st Innings.		*2nd Innings.*	
Major J. Spens, c DuCane, b Waymouth	31	b Butler	7
Capt. Wynyard, c Tomkins, b Butler	12	c Elton, b Waymouth	12
H. J. Mordaunt, c Tomkins, b Butler	0	b Butler	37
L. K. Jarvis, c Waymouth, b Butler	7	c Tomkins, b Butler	1
E. C. Mordaunt, b Waymouth	30	c Boulnois, b Butler	7
G. F. Vernon, c Waymouth, b Butler	13		
H. F. de Paravicini, c Perkins, b Findlay	37		
C. C. Cottrell, run out	42	c Boulnois, b Waymouth	1
S. W. Cattley, not out	27	not out	21
Capt. Cooper-Key, c Tomkins, b Butler	2	not out	32
C. Heseltine, c Davidson, b Butler	2		
C. C. Clarke, b Butler	22		
Extras	18	Extras	4
Total	253	Total (for 6 wicket)	122

OFFICERS R.A. *v.* N.-C.O.'s R.A.

PLAYED AT WOOLWICH, 13TH AUGUST.

R.A. OFFICERS.

Major Davidson, c Fulcher, b Butler	8
G. R. M. Mathew-Lannowe, l b w, b Young	12
Capt. A. J. Abdy, b Butler	30
H. D. White-Thomson, b Butler	13
Colonel J. W. Inge b Young	4
" J. F. Brough, b Butler	0
F. A. G. Y. Elton, b Butler	14
Capt. H. L. A. Jenkinson, b Young	2
W. H. W. Perrott, c Bailey, b Butler	2
P. G. Godfrey-Faussett, not out	7
H. L. Kirke, b Butler	0
R. S. Macgowan, b Butler	28
Extras	29
Total	149

N.-C. OFFICERS.

Q.-M.-Sergt. Hunter, b Lannowe	43
C.-S.-Major Savage, b Macgowan	1
Sergt. Young, l b w, b Davidson	24
Bombr. Butler, c Macgowan, b Davidson	0
School-Master Atkinson, c Abdy, b Lannowe	13
Sergt. Fulcher, c Kirke, b Macgowan	64
Sergt.-Major Polson, c White-Thomson, b Macgowan	13
School-Master Watts, c Inge, b White-Thomson	6
Corpl. Adams, b Macgowan	0
Sergt. Seville, b Elton	19
Corpl. Giles, b Lannowe	10
" Bailey, not out	0
Extras	12
Total	205

DIARY OF FIXTURES.

SEPTEMBER.

Day of the Mth.	Wk.	Regimental.	Cricket, &c.	Private.
1	Th	... ...	... ...	... ...
2	F	... ...	Sandown Park begins.	... ...
3	S	Long Course goes to Western Forts.	R.A. Woolwich *v.* Blackheath at Blackheath.	... ...
4	S	... ...	... ...	... ...
5	M	... ...	... ...	... ...
6	T	... ...	Doncaster begins.	... ...
7	W	... ...	St. Leger.	... ...
8	Th	... ...	... ...	... ...
9	F	... ...	... ...	... ...
10	S	... ...	... ...	... ...
11	S	... ...	... ...	... ...
12	M	Special Class Officers begins.	... ...	... ...
13	T	... ...	... ...	... ...
14	W	... ...	... ...	... ...
15	Th	... ...	... ...	... ...
16	F	Long Course leaves Western Forts.	... ...	... ...
17	S	... ...	.. ...	... ...
18	S	... ...	... ...	... ...
19	M	... ...	... ...	... ...
20	T	Lecture at noon at Shoeburyness on "Hydraulics as applied to the Service of Artillery," by G. H. Banister, Esq., Royal Carriage Department.	... ...	... ...
21	W	Lecture at R.A.I. Woolwich, at 9 p.m., on "Okehampton Experiences, 1892," by Capt. E. W. Blunt, R.A.	... ...	... ...
22	Th	... ...	... ...	... ...
23	F	Lecture by G. H. Banister, Esq. (Contd.)	... ...	... ...
24	S	... ...	... ...	... ...
25	S	... ...	... ...	... ...
26	M	... ...	... ...	... ...
27	T	Lecture by G. H. Banister, Esq. (Contd.)	Newmarket 1st October Meeting begins.	... ...
28	W	... ...	... ...	... ...
29	Th	... ...	... ...	... ...
30	F	Lecture by G. H. Banister, Esq., (Contd.)	... ...	... ...

OCTOBER.

1	S	... ...	... ...	... ...
2	S	... ...	... ...	... ...
3	M	... ...	... ...	... ...
4	T	Lecture at noon at Shoeburyness on "Attack of War Vessels by Coast Forts," by Captain Orde-Browne.	... ...	... ...

OCTOBER.—*Continued.*

Day of the Mth.	Wk.	Regimental.	Cricket, &c.	Private.
5	W	... ...	... ...	... ...
6	Th	Lecture at R.A.I. Woolwich, at 5 p.m., on "The Sudan, Past and Present," by Maj. F. R. Wingate, *D.S.O.*, R.A.	... ...	... ...
7	F	Lecture by Captain Orde-Browne. (Contd.)	... ...	... ...
8	S	... ...	... ...	... ...
9	S	... ...	... ...	... ...
10	M	... ...	... ...	... ...
11	T	Lecture at noon at Shoeburyness on "Employment of Iron Cupolas," by Captain Orde-Browne.	Newmarket 2nd October Meeting begins.	... ...
12	W	... ...	... ...	... ...
13	Th	... ...	... ...	... ...
14	F	... ...	... ...	... ...
15	S	... ...	... ...	... ...
16	S	... ...	... ...	... ...
17	M	... ...	... ...	... ...
18	T	... ...	... ...	... ...
19	W	... ...	... ...	.. ...
20	Th	... ...	Sandown Park begins.	... ...
21	F	... ...	... ...	... ...
22	S	... ...	... ...	... ...
23	S	.. ...	... ...	... ...
24	M	... ...	... ...	... ...
25	T	... ...	Newmarket Houghton begins	... ...
26	W	... ...	.. ...	... ...
27	Th	... ...	... ...	... ...
28	F	... ...	... ...	... ...
29	S	... ...	... ...	... ...
30	S	... ...	... ...	... ...
31	M	... ...	... ...	... ...

NOVEMBER.

1	T	... ...	... ...	... ...
2	W	... ...	... ...	... ...
3	Th	... ...	... ...	... ...
4	F	... ...	... ...	... ...
5	S	... ...	... ...	... ...
6	S	... ...	... ...	... ...
7	M	... ...	... ...	... ...
8	T	... ...	... ...	... ...
9	W	... ...	... ...	... ...
10	Th	... ...	... ...	... ...
11	F	... ...	... ...	... ...
12	S	... ...	... ...	... ...
13	S	... ...	... ...	... ...
14	M	... ...	... ...	... ...
15	T	... ...	... ...	... ...
16	W	... ...	... ...	... ...
17	Th	... ...	... ...	... ...
18	F	... ...	... ...	... ...
19	S	... ...	... ...	... ...
20	S	... ...	... ...	... ...
21	M	... ...	... ...	... ...
22	T	... ...	... ...	... ...
23	W	... ...	... ...	... ...
24	Th	... ...	... ...	... ...
25	F	... ...	... ...	... ...
26	S	... ...	... ...	... ...
27	S	... ...	... ...	... ...
28	M	... ...	... ...	... ...
29	T	... ...	... ...	... ...
30	W	... ...	... ...	... ...

PRÉCIS

AND

TRANSLATIONS.

"REVUE MILITAIRE DE L'ETRANGER."

APRIL, 1892.

"THE LAST CAMPAIGN IN CHILI."

BY

LIEUT.-COLONEL J. H. G. BROWNE, LATE R.A.

THE writer of an article on the last campaign in Chili in the *Revue Militaire* begins by saying that the campaign deserves particular attention with special reference to the employment of small arms. He gives a somewhat detailed account of the action of Concon on the Aconcagua, near Valparaiso, where the Balmacedist Generals, Barbosa and Alçerreca, had taken up a strong position with 12,000 men. Colonel Canto, at the head of nearly 10,000 Congressists, disembarked from his transports without molestation. On the morning of the 21st August, 1891 he advanced on a front of about three miles, and began the passage of the Aconcagua. An "artillery duel" then took place, in which the Congressists were materially assisted by the fire of the armed cruiser, *Esmeralda*, which was moored at the mouth of the Aconcagua in a position which enabled it to enfilade the enemy's line. After about an hour of this work, the Congressist infantry were ordered to advance across the river, and they gained a complete victory, carrying the enemy's first and second lines of defence, and capturing nearly the whole of his artillery and 1500 prisoners. General Barbosa lost nearly one-fourth of his whole force in killed and wounded, besides a large number of missing, while the Congressists lost more than a tenth of their force in killed and wounded. These proportions bear witness to the obstinacy of the fighting.

The writer of the article attributes the defeat of the Balmacedists to several causes, such as the division of command between Barbosa and Alçerreca; the resolve to await the advance of the Congressists behind the Aconcagua, instead of attacking them on disembarkation; and the presence of the armed flotilla, whose fire actually took a great part of their position in reverse. On the other hand, the three brigades of the Congressists had to advance down slopes which were

swept by the enemy's fire, cross a hardly fordable river, and then attack two tiers of heights, one above the other.

The accounts hitherto received give very little detailed information as to the tactical formations employed on either side. The Congressists seem to have carried out their attacks by means of strong chains of skirmishers, supported by échelons in close formations. On the other hand, Barbosa seems to have made too much use of close-order formations, for which he had a marked preference. Another cause of the inferiority of the Balmacedists was their armament. One-third of the Congressists were armed with the "Mannlicher"[1] repeating rifle, which is reported to be a weapon of very superior quality, combining accuracy of fire with simplicity and strength of construction, in a manner which largely contributed to the confidence of the insurgents and to the demoralisation of the Balmacedists.

The Balmacedists attributed 56 per cent. of their losses (instead of 33) to the fire of the Mannlicher rifle. Salvoes or skirmishing fire at ranges of from 1000 to 1600 metres[2] completed swept the ground and stopped their advance. According to the accounts of prisoners, fire directed at a range of 600 metres against the lines of skirmishers on the south of the Aconcagua sufficed, in consequence of the peculiar conformation of the ground, to carry disorder into reserves placed at from 1000 to 1600 metres in rear. The Balmacedists, who fought at Placilla about a week after this action, would not come within 1000 metres of the enemy; while, on the other hand, the insurgents acquired such a confidence in their arm that they would willingly have attacked a force very superior in numbers to themselves.

The ease with which the arm is handled was sufficiently proved by the fact that recruits, after three days' exercises and one or two practices on rests, made, at a range of 100 metres, a percentage of 28, 15, and 12 hits respectively, upon targets representing skirmishers standing, kneeling, and lying down. With the same targets at 200 metres, a percentage of 24, 13, and 9 hits was obtained, and at 500 metres, a percentage of 16, 9, and 5. The strength of construction was equally demonstrated. In spite of the inexperience of the recruits and the fact that each arm must have fired from 160 to 200 rounds in the affair of the 21st August, not more than 7 or 8 per cent. of the rifles required repair: 3 or 4 per cent. of these repairs were connected with the extractor, and a large proportion of the remainder with the elevator.

Provision against accidents to the extractor had been made by distributing a reserve of one-eighth. The number to be replaced, however, never exceeded 4 or 5 per cent. This operation was carried out very easily, and without any special instrument. The arm of the lever of the elevator was injured from the soldier having to use some force in loading in consequence of the chamber becoming dirty; the rifle, however, could still be used as a non-repeater. This was also the case when sand got into the lower part of the magazine, as sometimes happened when the marksman fired lying down on the ground.

The grease, with which the cartridges were formerly covered, had previously been done away with, as it was found to interfere with the working of the rifle. This occasioned an increase in the heating of the barrel; but the temperature hardly ever increased after the twentieth round, and, thanks to the wooden stock, the arm could be easily handled even after the hundredth round.

The wounds caused by the "Mannlicher" rifle are said to have been of a peculiar and humane character. Even at long ranges the bones and sinews were cleanly cut without tearing or leaving splinters of metal behind. Extracted bullets were found to be intact.

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[1] This weapon seems to be the same as that in use in the Austrian Army.—*J.H.G.B.*

[2] A metre is equal to 39 inches very nearly.—*J.H.G.B.*

But the "Mannlicher," in common with all repeating rifles, has the great disadvantage of leading to the consumption of an enormous quantity of ammunition at the time when it becomes more and more difficult to replace. This is especially the case with raw levies like those of Colonel Canto. The Congressists, although they had from 180 to 200 rounds apiece, ran short of ammunition after firing for an hour-and-a-half, at the very time when their consumption of ammunition should have increased. This serious inconvenience is difficult to provide against. According to the experience of the Chilians, it is impossible, at any rate when acting on the offensive, to bring up cartridges from the ammunition reserve to the skirmishing line, as the intensity of fire prevents any regular system of communication. The supply of ammunition which could be obtained from the killed and wounded would be very insufficient, and would not always be found where most required.

After this combat of Concon, part of the Congressists remained for more than 12 hours with only five or six rounds apiece—or almost completely disarmed. It had been found impossible to make a fresh distribution over night, and the ammunition reserve did not come up for some hours.

In spite of this drawback, the *Reichswehr* considers that the great superiority of the Mannlicher over the other rifles was clearly established. Its appearance on the battle-field might be compared to that of the needle-gun at the combat of Nachod in 1866. The advantage of the repeating rifle was again shown at Placilla on August 28th.

After his defeat at Concon, Barbosa retreated upon Vina del Mar on the north side of Valparaiso, where he was joined by a reinforcement of 4500 men who had already come up from the south. Colonel Canto advanced directly on Valparaiso on the morning of the 22nd August, but, finding the enemy's position too strong to be taken by a *coup-de-main*, he put off the attack till the next day. On the 23rd the armed flotilla opened fire on Fort Callao at 2500 metres, while the Congressist artillery commanded the heights, but the Balmacedist artillery proved the stronger, and in the meanwhile Colonel Canto had changed his plans. Instead of attacking Valparaiso on the north side, where he would have to deploy his troops under the fire of the forts, he determined to confine himself to a demonstration in that direction, and then to march upon Quilpué with the view of capturing the heights which command Valparaiso on the south-east.

Thanks to the precautions taken and to the inactivity of the enemy's cavalry, this movement was successfully carried out. On the night of the 24th August the Congressist advanced-guard cut the Valparaiso-Santiago railway in spite of the arrival of an armour-plated train, and Colonel Canto, continuing his movement, occupied Quilpué, and there halted till the morning. Balmaceda was not aware of the movement until the morning of the 26th. He then directed his troops upon Placilla to the south-east of Valparaiso, which they reached on the evening of the 26th, and there received reinforcements, which brought their strength up to about 10,000 men.

Colonel Canto, on receiving this intelligence, made two night marches on the 25th and 26th, preferring the cold of the night to the heat of the day. In spite of the difficult nature of the country to be traversed, his vanguard reached Las Cadinas, a farm about two miles from Placilla, at 3 a.m. on the morning of the 27th. The rest of the troops followed, and Colonel Canto devoted the rest of the day to preparing for a decisive attack on the morrow. The ranks of the Congressists had been swelled by deserters and prisoners to a total of nearly 12,000 men, while the Balmacedists only numbered from 9000 to 10,000, still placed under the orders of Barbosa and Alçerreca, whose views were seldom in agreement. The defenders occupied a front of about two miles, most of their guns being placed in the centre, while the infantry on their front and flanks crowned slopes whose very steepness, while it rendered them difficult to climb, prevented the

approaches from being effectively swept by the defender's fire. The cavalry was in reserve behind the centre, while one battery was on the extreme right, where Balmaceda seems to have expected the principal attack, in order to cut him off from his point of disembarkation at Laguna. The attack began all along the line on the morning of August 28th. Balmaceda, who remained strictly on the defensive, sent some of his reserves up to support his right, but in the meanwhile his left was driven in despite the fire of his artillery and several cavalry charges. In the centre the Congressists made slow progress, but on the enemy's right they were held in check, until Colonel Canto, judging the moment favourable, ordered his cavalry to charge. The cavalry climbed the steep slopes and issuing suddenly upon the already shaken infantry completely routed them. Barbosa was killed in trying to check the enemy with 100 horsemen, and Alçerreca vainly attempted to prolong the struggle. At half-past ten the battle was over; all the Balmacedist artillery and 3000 prisoners fell into the hands of the Congressists. The latter lost from 1400 to 1600 men in killed and wounded; while the loss of the Balmacedists is variously estimated at from 800 to 1500.

This disaster finished the campaign; the Balmacedists made no attempt to prolong it, and on the same day Colonel Canto entered Valparaiso, which was only seven or eight miles from the field of battle.

The writer of the article makes the following remarks with reference to the second part of this campaign.

(1.) Night marches were frequently resorted to. These were rendered almost necessary in consequence of the rapid variations in temperature between daytime and night, which occur in the climate of Chili.

(2.) The cavalry did little outside the field of battle, owing to the nature of the country and their own defective organisation. On the other hand, they found several opportunities of acting on the battle-field, and the decisive defeat of the Balmacedists at Placilla is largely attributed to the action of Colonel Canto's cavalry.

(3.) The artillery, weak as compared with the other arms, appears to have done less at Placilla than at Concon. It was composed of mountain guns, and the conformation of the ground was unfavourable to the movement of that arm.

(4.) Attention has already been called to the important effect produced by the "Mannlicher" rifle, with which one-third of the Congressists infantry was armed.

(5.) It would seem that frontal attacks are becoming more and more difficult, as the armament of troops progresses. At Placilla the frontal attack against the Balmacedist right could make no sensible progress until their left had been driven in. It may be assumed that this difficulty in making a direct attack would have been increased if the Balmacedists had been armed with repeating rifles.

(6.) The above remarks must be discounted to some extent in consequence of the composition of the contending forces. The Balmacedists had the best trained men, but were badly organised and led, while the Congressists had the advantage in the point of armament. But the proportion of losses shows that courage was not wanting on either side, and real importance may be attached to this eight days' campaign.

"MILITÄR WOCHENBLATT."

29th JUNE, 1892.

COMPARISON OF THE MOST IMPORTANT REGULATIONS OF FOUR CONTINENTAL POWERS AS REGARDS THE DEFENCE.

TRANSLATED BY

COLONEL LONSDALE HALE, LATE R.E.

GERMAN.

THE regulations lay down as the principle: "It depends on the profitable use of the fire-arms; thus is determined, therefore, the selection of the position and skilful strengthening of the same." The shooting line will from the commencement be as strongly held as is necessary for the object of the fight. The position is to be strengthened, the distances indicated by marks, ammunition distributed and kept in readiness; the supports are to be drawn forward and all distances in depth diminished. The number and breadth of the sections varies according to the ground, each is a unit of command with its own reserve.

The main reserve is to be placed where it can pass to the offensive, which is necessary if a victory is sought for. As a rule, this place is on one of the wings, the more to the flank as the defending force is larger; by this means the danger from turning movements is at the same time guarded against. The position is occupied as soon as the direction of the attack is known.

RUSSIAN.

As principles are accepted: advantageous employment of fire-arms, then counter-attack with the bayonet.

In selecting a defensive position, the field of fire, cover and distances are to be taken into consideration; weak points to be occupied more strongly, artificial cover and communications provided, flank protection is to be attended to. The development of fire takes place gradually; the ammunition is to be reserved for short ranges. The fire will be specially directed on the attacking shooters when they rush forward; the attack is repulsed by volleys delivered by the reserve from the shooting line. If the enemy does not hold his ground, the shooting line and the reserve attack him with the bayonet, and where possible by a part of the reserve on his flank. The reserves must, therefore, for this purpose be drawn forward in time. After repulse of the attack the enemy is followed up with fire. During a retreat individual shooters fire; positions chosen in rear are to be occupied; the reserves retire with the shooters in quick time.

AUSTRIA.

The principles are : utilisation of the ground and profitable employment of the fire-arm.

The offensive must always be combined with the defence if a decisive success is aimed at. Field for fire, depth, freedom for movement must be taken into consideration in choosing a position. The strength employed must correspond to the object of the fight. A weak occupation at the commencement is faulty. Patrols are sent to the front to watch. The position is divided into sections, each with its own reserve. Some points are more important to occupy than others ; a uniform distribution of troops is incorrect. Independent points for defence receive special garrisons.

A strong main reserve is posted behind one flank. Until the enemy's intention is apparent the troops are held in readiness ; the protection being entrusted to patrols. Reconnoitring, measuring ranges, arranging cover, are to be taken in hand. The reserve is drawn forward near to the front line. As soon as the direction of the attack is known the position is strongly occupied.

On the columns and guns fire is opened at long ranges ; on the most threatening enemy at medium ranges ; at short ranges fire from all available troops.

If a counter-attack is intended the main reserve may not be employed for any other purpose ; it must deploy quickly when the attacker has arrived at deciding distance, open on him a powerful flanking fire and then attack with the bayonet. Counter-attacks from the shooting line are to be avoided.

If a counter-attack is not intended, the main reserve strengthens the shooting line or meets any flank attack. Pursuit is carried on by fire.

FRENCH.

The defence relies on fire and suitable employment of ground. Passive defence is absolutely rejected. Active defence turns to account the advantage of the choice of ground and the expectant attitude only as an increase of strength in order to beat the enemy in a known position more certainly and under more favourable circumstances.

The Commander pays attention to the advantages for offence and defence, the line of defence, supporting points, flanks, communications to the front and in rear ; points of assembly and line of retreat. According to their considerations follows the distribution of the sections to the lower commands and the construction of defensive works.

The lower leaders at once make themselves acquainted with the ground in front of them and the contiguous positions, find supporting points, ascertain ranges, and communicate them to those under their orders. The Commanders of the supports mark the lines of approach to the lines of defences. If the fight is not to commence at once, the Commander sends forward only enough men to watch and to carry out the defensive works. The remainder are held in readiness to advance in a protected position. The formation is generally the same as that for attack. The front to be held by a company is about 200 metres (220 yards) without uniform occupation being necessary.

The choice of position for the supports depends on the probable fall of the enemy's projectiles. If the ground allows, the depth of the formation is to be diminished. On the approach of the enemy the patrols report his strength, proceedings, and direction of his attack ; their first resistance can compel him to deploy and reveal his intentions. On this the Commander comes to a decision. As soon as the attack is pronounced the position is occupied.

Fire is opened as soon as it becomes effective. The intensity of the fire depends on the range and the importance of the target : the best shots fire on the hostile leaders. When the enemy approaches and his fire increases, the supports

gradually strengthen the shooting line in order to give the necessary amount of fire. The reinforcements should either prolong the line or enter it, never cause it to close. Detachments will be told off to fire on the supports and reserves, whilst the others reply to the fire of the enemy's shooting line. By the time the enemy is arrived at 400 metres (430 yards) from the position, ordinarily the supports will have been absorbed in the shooting line, and the defence will be continued with the aid of the companies in reserve. The counter-attack is carried out by the companies in reserve. If the attack fails, the pursuit is continued by fire, and the defence prepare to assume strongly the offensive. If the attack succeeds, the companies are disengaged under the protection of the fire of closed detachments, and collect at some spot determined beforehand by the Battalion Commander.

COMPARISON.

All four regulations bring forward prominently as the main principles the utilisation of fire and the judicious use of ground. As regards the former, the Russians develop fire gradually; the French, on the contrary, orders fire to open as soon as the enemy can be hit; the Germans act according to their own Musketry Regulations. The Austrians use fire mainly at medium and short ranges, and only at long ranges when the ammunition is sufficient and the target large. All the regulations, with the exception of the Germans, recommend the constant employment of volley firing. As regards the choice of the position and the measures for strengthening it, the regulations are in accord, as also in respect to the division into sections, diminution of depths, section reserves in readiness in covered positions, a sufficiency of troops for the occupation of the position when the line of attack is known, and an independent main reserve, if possible, behind a flank. On the last point, the Germans emphasise the advantage of a simultaneous flank advance, and expressly lays stress on the fact that it is wrong to hold back the main reserve to protect the retreat instead of employing it in the fight.

The French reject *in toto* the passive defence, and insist always on the offensive. The Germans and Austrians only if a decisive success is intended. The Russians on the order of the Commander if the assailant is to be shattered.

From the foregoing it is evident that the four regulations are practically in accord as regards the attack and defence; success depends, therefore, on which troops are best led, trained, and disciplined.

"INVALID RUSSE."

CAVALRY SWIMMING.

BY

MAJOR E. A. LAMBART, R.A.

An order by General Skobeleff to the 4th Army Corps of the 15th June, 1882, contains the following :—

"I do not admit the possibility of men swimming on their horses in full marching order except over very small streams with firm bottoms, and I consider that swimming, commencing with small rivers such as the Sooprasl (105 feet broad) and going on to regular rivers such as the Danube, Wisla, Amoor and Syr Dara, is best carried out by one of the following three methods tried experimentally by three spuadrons of the 4th Dragoons on the 12th June."

The following is a summary of these three methods :—

(1) *Narrow rivers.* The uniform and equipment of men and horses is carried over on rafts or small boats, and the men swim their horses over on watering bridles only.

(2) *Broad and swift rivers.* The men cross on boats or rafts with their equipments as before ; the horses bitted up, swim over in squads following a few guides selected from the best swimmers, on their horses.

(3) *In the absence of boats and rafts.* A few experienced swimmers, one of them tied round with a long thin rope, swim to the opposite bank, and then with the rope pull across an axe and a picket rope which is made fast to a stake or tree. The picket rope is then tautened and made fast at the starting point. A detachment of the best swimmers is then sent across without their horses, and taking with them in a bundle round their necks the necessary clothing and their rifles, ammunition and entrenching tools. This detachment takes up a position to cover the crossing, establishing visual signalling communication with the rest. The remainder of the men then cross holding by the rope, with their kits, etc., slung round their necks. The use of several picket ropes of course materially quickens the operation. Last of all the horses are sent over in squads with the bits on the rear arches of the saddles.

In connection with these orders of the illustrious Skobeleff, it is worth while to bring to notice an invention, designed to materially assist cavalry in crossing rivers. The invention (of a Sub-Lieutenant in the Semenovski Life Guards) consists of a canvas bag water-proofed, and fitted with a cork that seals it hermetically. Its weight is about $2\frac{1}{2}$ lbs., length $4\frac{1}{2}$ feet, and width $2\frac{1}{2}$ feet.

This bag filled with the uniform and accoutrements of the man and the whole of his saddlery, etc., and corked tightly, not only does not sink, but can even support some additional weight. One end of the bag is fitted with a rope having a large loop.

On the 8th July, 1890 (says the writer) at the request of the inventor, I tried these bags on the river Sooprasl near *Baylostok* with excellent results.

Accompanied by my orderly I went to the river, and having packed our uniforms, arms, etc., in the bags and slung them round our necks, we jumped our horses into the water, holding on by their manes and crossed the river backwards and forwards several times. The bags towed behind us and did not hamper our horses in the river in the least. After this we tied the ropes to bushes on the bank and let the bags remain in the water for more than half-an-hour without any of the contents getting damp.

A pack animal carrying 80 to 100 bags might easily accompany each squadron in dragoon and cossack regiments on service.

In case of detachments of less strength than a squadron, the bags might be slung to the rear arch of the saddles. It would not do, however, to carry the bags on the saddles permanently, as they add to the already heavy equipment, and besides the rubbing would quickly wear out the bags—for this reason I suggest pack animals.

This invention certainly deserves attention, especially when we consider that, though swimming rivers is now part of the programme of our summer drills, many officers and men fail to become good swimmers owing to their being quartered at a distance from water. Moreover, even at manœuvres, there have been cases of drowning when the swimming practice is being carried out.

In peace-time, as a rule, drowning men can be rescued, but in war-time there is no time for this, and though our cavalry are trained to make light of all risks on service, in the moment of the charge every sabre counts.

One of our most distinguished cavalry leaders says of this invention :—

"In the days of armed peace in which we now live, so valuable an invention must be made known as quickly as possible. I am personally convinced that this invention is of very great importance in independent cavalry operations, in raids in the theatre of war, and particularly in 'partisan' warfare.

If we make use of it, neither the Wisla, the Narva, nor the Bug will stop us."

July, 1892.

NOTES

FROM

CORRESPONDING MEMBERS.

THE subject for the Duncan Gold Medal Prize Essay, 1893, is "The Attack of a Coast Fortress."

Attention is called to the Rules for Prize Essays printed at the end of the Rules R.A.I., and Officers are asked to be careful in posting their Essay intended for competition in time to reach the Secretary on or before the 1st of April.

ANY member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

IN order to bring the already existing printed Records of the R. M. Academy up to date, it has been found that there will be a much larger amount of letter-press to be added than was at first anticipated. In consequence of this it has become necessary to raise the estimated price per copy from 12s. 6d. to 15s.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

COPIES of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

THE Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

THE following works are now on sale at the R.A. Institution and will be forwarded post free at the prices noted after their titles below :—

Major-General Stubbs's "List of Officers of the Bengal Artillery," price 5s. 3d.

"Field Artillery Fire," by Captain W. L. White, R.A., price 1s. 2d.

"Notes of Lectures on Artillery in Coast Defence," by Major A. C. Hansard, R.A., price 1s. 2d.

"Ranging Note-Book," by Captain S. W. Lane, R.A., price 1s. 1d.

STAFF COLLEGE ENTRANCE EXAMINATION, 1893.

Army Order 143 of 1892 :—

1. At the examination for admission to the Staff College, to be held in May, 1893, questions in Military History will be set as follows :—

(*a.*) On Parts I.—V. of the "Operations of War," excluding the details of the movements recorded in Chapter iii., Part V.

(*b.*) On the Physical Geography of France, the German Empire, Holland, and Belgium.

Maps in good atlases and articles in geographical dictionaries will furnish all the information necessary for answering questions under this head. A knowledge of the details of the ramifications of mountain systems, or of small tributary river basins, will not be required.

(*c.*) On the Campaign of the first German Army in the North of France, from the advance of the Army to the Somme, 16th November, 1870.

Only the period from the 1st January, 1871, need be studied in detail. Questions on the previous part of the Campaign will be confined to the main incidents, the principal movements, and their object.

Sketch Maps of the Theatre of War and of the Battlefield of St. Quentin will be supplied at the examination to the candidates.

The Campaign is narrated in the under-mentioned sections of Major Clarke's authorised translation of the Franco-German War, 1870–1, Sec. XIV., price 4/-; Sec. XV., price 2/6; Sec. XVII., price 3/-. The analytical index (price 1/6) to the translation, compiled by Colonel Lonsdale Hale, will be found useful.

Books Recommended for the Staff College and Promotion Examinations.

BY

MAJOR EDEN BAKER, R.A.

[*Always follow the Syllabus in the Queen's Regulations closely.*]

MILITARY LAW.

LIEUTENANTS.—Army Annual Act, 1892.
Military Law, by Lieut.-Col. Pratt. 7th edition. 1892.
Army Act. Part II.
Reserve Forces Act, 1882.

CAPTAINS, IN ADDITION TO THE ABOVE:—
Army Act. Parts III., IV., V.
Militia Act, 1882.

FIELD FORTIFICATION.

Instruction in Military Engineering. Vol. I., Part 1, 1888 (*omit* fougasses and large inundations). N.B.—A new edition is now in the press.

Manual of Elementary Field Engineering (*omit* Sections 12 to 15, 18, 20).

Defence and Attack of Positions, by Colonel Schaw. 3rd edition. *Read* chapters 5, 7, 8 and 9.

Infantry Drill, 1889. 3 to 6 hours' breastwork, Plate XLII.

PERMANENT FORTIFICATION.—*Staff College only.*

Text-book of Fortification for use at R.M.A., Woolwich, 1878. Part I., pages 132 to 191 ; Part II., pages 1 to 108 and 138 to 145.

MILITARY TOPOGRAPHY.

Text-book of Military Topography, 1888 (*omit* Sections 13 to 24 and 26 to 28).

Short Notes on Tactics and Reconnaissance, 1887, by Major J. R. J. Jocelyn, R.A. *Read* pages 65 to 81 and 84 to 94.

TACTICS.

Infantry Drill, 1892. *Read* page 59, 3rd and 5th paras. ; page 61, 1st para. ; page 79, 2nd para. ; pages 83 to 89 ; pages 99 and 100 ; page 102, sections 3 to 6 ; pages 105 to 185.

Short Notes on Tactics and Reconnaissance, by Major Jocelyn. *Read* pages 7 to 62, but note that Infantry formations have been altered by Infantry Drill 1892, and Artillery Intervals and Distances by Field Artillery 1889. For Lieutenants Promotion Examination *read* only up to heading 15.

Minor Tactics, by Colonel Clery. 6th edition, *Read* Chapters IX., X. and XX.

Preliminary Tactics, by Major Eden Baker. 1892. *Read* Ammunition Supply (the Battery Supply System has been altered), Time and Space (note that page 49, lines 6 to 16, and 29 and 30, have been been altered), and Marches.

ARTILLERY.—*Lieutenants R.A. for Promotion Examination.*

Text-book of Gunnery, by Major Mackinlay. Chapters I., II., XII., XIV., XVII.

Treatise on the Manufacture of Guns, 1886.

Treatise on Military Carriages, 1888.

Treatise on Ammunition, 1892.

Handbook of Artillery *Matériel*, by Major Morgan, 1892.

Field Artillery Drill, Vol. II., 1891.

Manual of Garrison Artillery, Vol. I., 1887.

Handbook for Field Service, Vol. I., Field Artillery. *Omit* Parts I., IV., VII., 1 and 3 ; VIII., 2 and 3 ; IX., 2 and 3 ; X. ; XI., 2, 7 and 10.

Regulations for Magazines, Ammunition Stores, Laboratories, &c., 1887.

Manual of Field Range-finding, 1890.

Handbook for the Depression Range-Finder, 1892.

STAFF COLLEGE ENTRANCE EXAMINATION, MAY, 1893.

MILITARY HISTORY.

Operations of War. Parts I. to V.

Lavalleé Military Geography. Translated by Captain Lendy.

Marga's Géographie Militaire. Vols. I. and II.

Official Account of the Franco-German War, 1870–1. *Vide* Syllabus.

The Campaign of the Army of the North, by Blume.

Faidherbe's Campagne de l'armée du Nord.

Officers going up for the Staff College Examination are recommended to read all Magazine Articles, Lectures, &c., that refer to Field Subjects.

Artillery College, Woolwich,
15th September, 1892.

GOLF.

As golf is now played by R.A. Officers in all parts of the world, and in many places these Officers are only Honorary Members of the Golf Clubs in the neighbourhood, and consequently rather shy about wearing the Club colours, it is suggested that a Regimental Golf Coat be started.

The coat suggested is to be of the ordinary red pattern, with Regimental buttons, having on the outside of the left breast pocket a gun of the Regimental crest pattern worked in blue (with or without "Ubique" underneath).

Officers having any ideas or wishes on the subject are requested to communicate them to the Secretary R.A. Institution as soon as possible, in order that the question may be settled forthwith.

HALIFAX, N.S.

Colonel Ryan, who went home on four months' leave, was accompanied by Mrs. Ryan, who does not return again to Halifax to the regret of everyone. Previous to her departure she was paid the unusual compliment of being invited to dinner at the R.A. and R.E. Mess, the party being a large one, including Sir John and Miss Ross, the Lieutenant-Governor of Nova Scotia, Mrs. and Miss Daly, and the officers' wives of the R.A. and R.E., besides the whole of the dining members.

Captain C. E. English, R.A., and Captain Mayne, R.E., have been here on duty from Kingston, Ontario, to undergo their examination for promotion, which was specially arranged for them at this time of year to coincide with the College Vacation.

The subject of grace at Regimental Mess Dinner has lately been discussed in some of the service papers, so it may be of interest to hear that at the last Quarterly General Mess Meeting a proposal that grace should be said before and after dinner every night was carried by 13—2.

The Dominion Artillery Association (Militia) have been holding their annual practice camp at Point Pleasant for a fortnight. Colonel Montizambert, the Camp Commandant, and his staff, were invited to dinner at the R.A. and R.E. Mess. As their uniform is exactly the same as that of the Royal Artillery they cannot be distinguished by it, though, perhaps, it is not so difficult to do so by other means. During the practice a 64-pr. gun, mounted on garrison standing carriage, was fired double-loaded with plugged shell. The first shell struck the sea at 500 yards, and the second at the proper range, 2000 yards. The gun was afterwards examined by the Inspector of Warlike Stores and first found to be still serviceable, but on a second impression being taken the bore was found to be unserviceable, the transverse crack in the breech having expanded from $\frac{1}{20}$ to $\frac{1}{3}$ inch. The recoil on firing was very great, the carriage running back off the ground platform. This is how a local newspaper describes the incident :—

A Big Racket.

"The artillery shootists at the Point have been firing at separate times from the same big guns. It appears that the full charge, shell and all, had been left in one of the guns, and the next party coming, not knowing this, also loaded it. It had, therefore, a double charge ; and when it was fired yesterday afternoon it almost raised the hair off the surrounding artillerymen and people in the vicinity. It was the biggest noise ever heard in that locality, and might have been attended with great danger. Had it burst (and it is a wonder it didn't), it would have killed a good many folk adjacent to it."

The past month has been a very gay one, with plenty of amusement in the way of polo, cricket, tennis, and yachting. There was a cricket tournament in which elevens from Philadelphia, Ottawa, and Halifax took part, and a lawn tennis tournament open to the Maritime Provinces. In the cricket match Halifax Garrison *v.* Philadelphia, Lieutenant Macgowan, R.A., bowled for the former. Half the Philadelphian XI. were entertained at dinner by the R.A. and R.E. and half by the Leicestershire Regiment.

Salmon fishing ends on 15th August. The Governor-General of Canada has kindly sent the Officers' Mess a magnificent 40 lb. salmon, killed in the Bonaventure River.

MALTA.

Owing to the public mourning in February, the dance, which had been arranged by the Royal Artillery, could not take place; in its stead a Gymkhana was given on the Marsa, towards the latter end of April, which afforded a very pleasant afternoon's amusement. In a very generous and sporting manner, the Field Officers subscribed for a Subalterns' Challenge Cup. This handsome piece of plate is to be run for annually, the conditions being as follows. For ponies the property of, and ridden by, Subalterns R.A.; 7 lbs. allowed for maiden jockeys; penalties for winners; half-a-mile on the flat.

The result was as follows:—

Mr. G. B. Hinton's Gamecock	Mr. Freeland	1.
Mr. H. L. N. Beynon's Robert the Devil	Owner	2.
Mr. J. F. Fisher's Cornet	Mr. Hardman	3.
Mr. J. F. Fisher's Specialist	Owner	0.
Mr. J. Chrystie's Whitewash	Mr. R. H. Parker	0.
Mr. A. Ellershaw's Carlton	Mr. E. H. Willis	0.
Mr. L. L. Parker's Jim	Owner	0.
Mr. H. L. Cottingham's Cagnotte	Owner	0.
Mr. D. R. Coates's White Rock	Owner	0.

Won by two lengths; half a length between second and third.

The other events consisted of:—An open half-mile handicap; a ladies' bracelet (three-quarters of a mile handicap); two matches, wrestling on horseback (teams of four-aside), and some foot races.

Mr. Freeland was on five winners during the afternoon. His loss to the garrison is much felt. A most enjoyable afternoon's entertainment was brought to a close by the distribution of the prizes by Mrs. Clayton.

A very successful R.A. Regatta was brought off on August 5th. No. 6 Company, Southern Division, were victorious in most of the events, including the Grand Challenge Cup open to the whole garrison, though the race being open to the garrison made little difference as the infantry and naval boats were unable to beat even the second crews which each R.A. Company had entered. Major Fanshawe easily won the sculling race open to all officers, but was disqualified for rowing in an English-built boat, so that Lieutenant Jeffcoat secured the handsome cup presented as a prize.

Amongst the officers who have left the command are:—Major Fulton, Lieutenants Walters and Freeland transferred to Mountain Batteries; Major Jones and Lieutenant Foster to Depôts; Captain Owen and Lieutenant Moloney to Field Batteries; Captain Blacker to Gibraltar; and Lieutenant Clark-Kennedy to India. These officers have been replaced by Captains White and Wynne, and Lieutenants Warren and Jeffcoat.

There has been a large amount of sickness amongst the R.A. officers during

the last year. Three are at present home on sick leave and two others have been transferred to depôts, while scarcely a week has gone by without there being one or more on the sick list. Although Malta has been called a "health resort" it does not keep up its reputation during the summer months. Poor Smith-Neil was only ill a few days before he died; he had been very ill during the previous summer and his constitution had not apparently thrown off the effects of his former fever, so that he made little or no resistance when attacked by enteric. A subscription list has been opened to erect a tombstone to his memory.

Malta is generally supposed to be such an excellent place to get home on leave to England for three-and-a-half months during the summer and autumn, but this has not been the case this year. Three subalterns were recalled from leave after they had been home only a few weeks, on account of some brawls which had occurred between the soldiers and natives; and the majority of the junior officers have not been able to get more than two months' leave.

The summer has been very hot. The average shade temperature taken at 4 p.m. was 82° during August.

Cricket began in August and the R.A. have played two Regimental matches on the Marsa; that against the Connaught Rangers ending in a draw, and that against the Queen's in a win for the R.A.

OKEHAMPTON.

Friday, the 19th August, was devoted to field firing, the troops engaged being the three Field Batteries at practice, viz., 13th, 61st, and 69th, one company of Royal Engineers in Camp; and infantry from Plymouth, from the Rifle Brigade, the King's Own Borderers, the Dorset Regiment, and Royal Marines, in all about 1200 men.

The ground selected was that known as No. 2 Range. The enemy, consisting of about 1200 dummies, was in a strongly intrenched position on East Mil Tor, with an advanced position some 1000 yards in front. On the extreme left of the enemy's advanced position a number of Hessian targets had been arranged to represent a village, and to protect this the sappers had thrown up an earthwork about five feet high, backed with 12-inch baulks of timber.

Between the village and the main position a stone fort had been built, one face of which was three feet thick, and unprotected; the other face two feet thick, with sods thrown up to cover it. On the top of the wall, sand-bag loop-holes were constructed, and dummies placed in position behind.

The enemy had one battery of artillery on East Mil Tor, and another on the bluff, the eastern slope of Yes Tor.

At 10 o'clock the advanced guard moved off from the Moor Gate to Holstock Hill with one battery of artillery, which at once came into action against the village at a range of about 1650 yards, and fired 60 rounds. The infantry then advanced to attack the village and other advanced positions of the enemy, and, after brisk firing, compelled him to retire on the main position of East Mil Tor. The remaining two batteries had in the meantime come into action on the left of the battery mentioned before, and all directed their fire on the enemy's guns, at ranges of from 2300 to 2700 yards. The firing was continued for 15 minutes, and then the artillery advanced to a second position, two batteries on the left, and one on the right, of the stream which flows down the range. The left battery came into action against the stone fort, at a range of about 1250 yards, and the remaining batteries against the entrenchments. After 10 minutes firing the infantry advanced and delivered the final attack on the main position, supported

by one battery, which came into action in an advanced position, but did not fire, as it was not considered safe.

The troops then returned to Holstock Hill, where they marched past before returning to Camp.

All the infantry, except Royal Engineers and Marines, were armed with the magazine rifle.

The effect of the fire was nearly 1800 hits on about 520 dummies; 700 of these hits were said to be due to shrapnel bullets. On the parapet in front of the village, the shells had done little damage, several having passed clean through without bursting, and only two of the baulks inside had been displaced. On the stone fort the effect was much greater, the wall being breached in several places, and large fragments of stone were thrown in all directions to a distance of 40 yards. It was evidently quite untenable from the first. Percussion shrapnel only were used against it.

SHORNCLIFFE.

The R.A. Sports took place on Wednesday, 21st inst. The principal events were as follows:—Tent-pegging, sections, won by 38th Field Battery; Driving Competition, by 52nd Field Battery; Wrestling on Horseback, 52nd Field Battery; Tug-of-War, 52nd Field Battery; Pig Sticking, a very amusing game imported from India by Lieut. Tulloch and open to all Officers South-Eastern District, won by Captain Leather, 5th Fusiliers. Colonel Curtis and the Officers R.A. entertained a large party, who thoroughly appreciated the selection of music played by the R.A. Band from Woolwich.

OBITUARY.

Captain J. B. Parkin, who died at Woolwich on 4th September, 1892, aged 62, entered the Regiment as Second Lieutenant on 27th June, 1848; became Lieutenant 1st November, 1848; Captain 1st April, 1855, and retired 6th July, 1857.

Lieutenant-Colonel Gravenor Kirby, whose death occurred at Aberdeen on 9th September, 1892, aged 81, joined the Bengal Artillery as Second Lieutenant on 10th December, 1830; became Lieutenant 6th December, 1839; Captain 10th December, 1845; Major 3rd October, 1857; and Lieut.-Colonel 24th March, 1858. He retired from the service 11th March, 1860.

DIARY OF FIXTURES.

OCTOBER.

Day of the Mth.	Wk.	Regimental.	Cricket, &c.	Private.
1	S	... ...	... ...	... ...
2	S	... ...	... ...	... ...
3	M	... ...	... ...	... ...
4	T	Lecture at noon at Shoeburyness on "Attack of War Vessels by Coast Forts," by Captain Orde-Browne.	... ...	... ...
5	W	... ...	... ...	... ...
6	Th	... ...	... ...	... ...
7	F	Lecture by Captain Orde-Browne. (Contd.)	... ...	... ..
8	S	... ...	... ...	... ...
9	S	... ...	... ...	... ...
10	M	... ...	... ...	... ...
11	T	Lecture at noon at Shoeburyness on "Employment of Iron Cupolas," by Captain Orde-Browne.	Newmarket 2nd October Meeting begins.	... ...
12	W	... ...	... ...	... ...
13	Th	... ...	... ...	... ...
14	F	... ...	... ...	... ...
15	S	... ...	... ...	... ...
16	S	... ...	... ...	... ...
17	M	... ...	... ...	... ...
18	T	... ...	... ...	... ...
19	W	... ...	... ...	.. ...
20	Th	... ...	Sandown Park begins.	... ...
21	F	... ...	... ...	... ...
22	S	... ...	... ...	... ...
23	S	.. ...	... ...	... ...
24	M	... ...	... ...	... ...
25	T	... ...	Newmarket Houghton begins	... ...
26	W	... ...	.. ...	... ...
27	Th	... ...	... ...	... ...
28	F	... ...	... ...	... ...
29	S	... ...	... ...	... ...
30	S	... ...	... ...	... ...
31	M	... ...	... ...	... ...

NOVEMBER.

1	T	... ...	... ...	... ...
2	W	... ...	... ...	... ...
3	Th	... ...	... ...	... ...
4	F	... ...	... ...	... ...
5	S	... ...	... ...	... ...
6	S	... ...	... ...	... ...
7	M	... ...	... ...	... ...
8	T	... ...	... ...	... ...
9	W	... ...	... ...	... ...
10	Th	... ...	... ...	... ...
11	F	... ...	... ...	... ...
12	S	... ...	... ...	... ...
13	S	... ...	... ...	... ...
14	M	... ...	... ...	.. ...

NOVEMBER.—*Continued.*

Day of the Mth.	Wk.	Regimental.		Cricket, &c.		Private.	
15	T	...	...	...	...	...	...
16	W	...	...	...	...	...	...
17	Th	...	...	...	...	...	...
18	F	...	...	...	...	...	...
19	S	...	...	...	...	...	...
20	**S**	...	...	...	...	...	...
21	M	...	...	...	...	...	...
22	T	...	...	...	...	...	...
23	W	...	...	...	...	...	...
24	Th	...	...	...	...	...	...
25	F	...	...	...	...	...	...
26	S	...	...	...	...	...	...
27	**S**	...	...	...	...	...	...
28	M	...	..	...	...	...	...
29	T	...	...	...	...	...	..
30	W	...	...	...	...	...	...

DECEMBER.

1	Th	...	...	...	...	...	...
2	F	...	...	...	...	...	...
3	S	...	...	...	...	...	...
4	**S**	...	...	...	...	...	...
5	M	...	...	...	...	...	...
6	T	...	...	...	...	...	...
7	W	...	...	...	...	...	...
8	Th	...	...	...	...	...	...
9	F	...	...	...	...	...	...
10	S	...	...	...	...	...	...
11	**S**	...	...	...	...	...	...
12	M	...	...	...	...	...	...
13	T	...	...	..	...	...	...
14	W	...	...	...	...	...	...
15	Th	...	...	...	...	...	...
16	F	...	...	...	...	...	...
17	S	...	...	...	...	...	...
18	**S**	...	...	...	...	...	...
19	M	...	...	...	...	...	...
20	T	...	...	...	...	...	...
21	W	...	...	...	...	...	...
22	Th	...	...	...	...	...	...
23	F	...	...	...	...	...	...
24	S	...	...	...	...	...	...
25	**S**	...	...	Christmas Day.		...	...
26	M	...	...	Bank Holiday,		...	...
27	T	...	...	...	...	...	...
28	W	...	...	...	...	...	...
29	Th	...	...	...	...	...	...
30	F	...	...	...	...	...	...
31	S	...	...	...	...	...	...

13

PRÉCIS

AND

TRANSLATION.

"INVALID RUSSE."

FIELD ARTILLERY OF THE FUTURE.

BY

MAJOR E. A. LAMBART, R.A.

A Russian writer in the *Invalid Russe* criticises the ideas of the German General Wille on the Field Gun of the Future as follows :—

In the first place the proposed gun of General Wille is designed principally on the idea of increasing the initial velocity of projectiles as compared with existing guns. This, for the last 70 years the favourite idea of technical artillerymen, has led, as is well known, to the impotence of field guns against earthworks, resulting in the universal introduction of field mortars. But General Wille apparently is not content with the considerable increase of velocity already arrived at—he wants to double it to reach a velocity of 2600 f.s. But what follows from this? In our opinion such a gun, as a field gun, will shoot very much worse than the present one. In firing at entrenchments this gun will not only *not* give increased striking effect, but considerably diminished for the reason that the splinters even of melinite shells, with such immense muzzle velocity, will strike the ground in a mass ; and the calculation of accuracy, in firing at objects in the open, is very problematical, for the flatter the trajectory the more exact must be the laying, and the relation of the line of sight with the axis of the bore must be the same identically at each round, which is unattainable in practice. We might even say with perfect confidence that if the inventors of guns with immense muzzle velocities could obtain an ideal trajectory—a straight line—the guns would be the very worst of field guns ; they would always strike over the heads of the objects aimed at, or far under, as mathematical accuracy in laying and fixing sights is not obtainable.

As an example of the inconvenience of the necessity for great accuracy in laying with flat trajectories, we may quote our own light gun of the pattern of 1877, a beautiful gun in all respects. It was often found in practice that at any particular elevation *all* the rounds were short and, with an increase of half a "line," all the rounds were over. It would seem therefore that an alteration of a quarter

of a line in elevation would have been very successful, but such nicety in laying in field artillery practice was unattainable.

In confirmation of this, that brilliant results do not depend only on the slope of the trajectory, we may also quote our present heavy field gun, which though it possesses a less flat trajectory, yet, thanks to the greater number of its striking fragments on burst very often gives much better results than the light gnn under similar conditions, especially on hard ground.

Secondly, the gun of General Wille, though of comparatively small calibre (2·75″), must undoubtedly be of considerable weight as it has a proposed length of 40 calibres and a large charge. Even if it does not surpass in weight the limits of existing field guns, it will at any rate require six horses to draw it, and consequently, the artillery will gain no advantage in mobility and in handiness for manœuvre. But is such a gun necessary at the present time in face of the necessity for rapid movements in battle and swift massing of batteries at critical moments? Judging by the experiments of Herr Krupp with a gun of 1730 f.s. muzzle velocity, General Wille's gun will undoubtedly be heavier than present ones, and, therefore, will be rather a position gun than a field gun. As regards its proposed rapidity of fire and special fragment-producing projectiles, these advantages will be considerably lessened by its enormous initial velocity, which gives a trajectory and a cone of dispersion absolutely disadvantageous in practice. We infer then that General Wille's gun cannot be considered an advantageous type of the Field Gun of the Future. To speak of the advantages of a single pattern of field gun—this only represents a *pia desideria* of theorists, but the practice of war does not always harmonize with theoretical organization. Even now with all this talk of having only one calibre, special types of guns of two or three calibres, such as mortars and howitzers are being introduced for high-angle fire. It is very probable that, in connection with smokeless powder and magazine rifles, a new calibre of gun may be introduced to restore the disturbed balance of power in military operations, but in *our* opinion a gun built on the following principles, as a supplement to our present one, is before all things necessary to effect that object.

(1.) The gun must be extremely light and mobile, suitable for very rapid advances, having as few horses in draught as possible, and the minimum number in its detachment. Batteries of such guns should work in all phases of the fight, "shoulder to shoulder" with the other arms.

(2.) The gun, firing smokeless powder, should have only moderate muzzle velocity. Even the present muzzle velocity of about 1300 f.s. may be looked on as a luxury. This condition must not at any rate interfere with the requirements of (1) and

(3.) The advantage of this gun, in addition to the above-mentioned mobility, should lie primarily in its rapidity of fire and the destructive effect of its projectiles, with large bursting charges, especially at medium and short ranges, but not in distant fighting. This last can be sufficiently well carried on by existing guns, which probably could fire corresponding charges of smokeless powder in the long range artillery duel.

July, 1892.

NOTES

FROM

CORRESPONDING MEMBERS.

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"Field Artillery Fire," by Captain W. L. White, R.A., price 1s. 2d.

"Notes of Lectures on Artillery in Coast Defence," by Major A. C. Hansard, R.A., price 1s. 2d.

"Ranging Note-Book," by Captain S. W. Lane, R.A., price 1s. 1d.

Special attention should be directed to a small work recently published by Messrs. Clowes and Sons, entitled "Studies in Applied Tactics," by Karl von Donat; it has been said of it: "No English work contains better hints as to how to write orders." Every officer going up for examination in Tactics should study this admirable little volume.

ADEN.

From the middle of May till the middle of July it was fiercely hot, then for seven weeks delightfully cool, indeed, on some days it was cooler here than in England, and now it has got hot again. Two Companies are accommodated in the New Barracks, which are very fine and large, with institute, refreshment rooms, billiard-room, temperance room, library, &c., complete. The barracks for the third Company are approaching completion.

After three years' continuous hard labour, irrespective of times, climes and seasons, there is a lull in armament work; the last regulation shift of a 30, odd, ton gun from a barge, up the side of a hill, on to an ordinary Mark VI., hydro-pneumatic carriage, has been accomplished in the record time of 2 months 29 days 23 hours 59 minutes 39¾ secs., and the smooth-bores, which were plentifully sprinkled along the miles of defences, have disappeared, as they are no longer required to frighten the Arabs; but though the most advanced inventions and appliances are promised; alas! armament pay is not, much less working pay.

The failure of the new Oriental Bank has driven some of us to take leave to Europe to try our luck with another bank which always pays up promptly in full, when you are the right colour; otherwise depositors don't get even 12s. 6d. in the pound.

The Polo Club was "at home" the other day, on the ground, which is seven miles from the R.A. Mess, in a corresponding situation to the Neutral Ground at Gibraltar. There were about 60 guests, including several ladies and children. The Captain of the three-funnelled Russian cruiser Pamyat Azova, which is in harbour, was there complaining that our testing practice shots, in the morning, went very close to his ship. Three R.A. Officers were playing; two other playing members have just left the station, one for England on leave, the other for India on duty, and there are two other R.A. members who play occasionally. Altogether we are fairly represented, and hold our own as a rule. If it were not so far to go it would be a "pleasant divarsion."

Colonel Bogie stayed with us for a few days, and a golf tournament was got up in his honour; only two competitors, both R.A. Officers, defeated him, and the honours of the handicap remained with Captain Hon. R. Tyrwhitt, handicap 14 points, score 58, total 44. The links have been described as one big bunker with hazards in between, but this is a libel. After rain, or when the course has been well rolled there is a good carry. Lieut. Lethbridge holds the record for the single round of nine holes with 48, and 2nd Lieut. Mayne—both of the "Battle Axe" Company—is one of the next best here. The racquet and lawn tennis courts are in good order and fairly well patronised.

Major Bailward gave 1000 rupees to start a fund to build a sticky court, and a yachting and boating club is to be formed. The voice of the turtle will soon be heard in the land, and then the R.A. Mess oyster catcher (he is not a bird, but an important official on 50 rupees a month) will show the water picnic parties where to go and turn him.

More than 100 lions have been shot in Somali land this season. Col. Curteis, A.A.G. Bombay, bagged eight in one day, most of which charged; another sportsman got three, and lost a fourth badly wounded, in one night. The following varied bag is Captain Harkness' record for four months:—Birds: quail to ostrich; he brought back a young ostrich which is now in the Zoo. Beasts, sporting: 19 digdig, 2 gazelle, 3 Waller's gazelle, 4 Sommering's gazelle, 2 hartbeeste, 3 kudu, 4 lesser kudu, 7 oryx, 10 wart hog, 1 lion which nearly made good his charge, but his jaw was broken and no lasting injury resulted, and 1 elephant. Beasts, non-sporting: Wild ass, wild dog, hyena, jackal, black-tailed fox. Wanting to complete: Panther, klip springer, lynx.

The journey to Somali land is one night by sea, a camel dâk of 40 miles, and

then three marches bring you into the 5000 foot region of trees, upland grass, meadows, violets and wild strawberries. No wonder a sporting Captain of an infantry regiment gave £150 for an exchange to Aden for six months, the understanding being that he was to spend the greater part of them in Somali land.

CEYLON.

Before dilating on the exploits of the R.A., by sea and land, I must point out the very great disadvantages under which the Royal Regiment exists in this island; the Officers R.A. number 16 and yet there is actually no R.A. Mess. In the writer's humble opinion the R.A. should be the premier corps in every way in this place, but they are not, and solely and entirely because there is no Mess; it has been represented to the authorities here, over and over again in the last two years, the very great need there is of a Mess. They quite allow it, but nothing is done. No doubt it is a slur on the Regiment, and it does the Regiment a very great deal of harm. War ships of foreign Powers are continually calling in, friends, brother officers R.A. and of all branches of the service are continually going through or sent to Ceylon for change, and here we are absolutely unable to show the smallest hospitality, or to have a corner even where people can leave cards. We all feel very strongly about it, but what is the good? we are in Ceylon!

It is a little difficult to find anything very interesting to record from this "penal settlement," as this beautiful island was designated the other day. There is one event we were a little proud of lately; the four officers of the 16 Company, Southern Division, R.A., won the four-oar race at the Annual Regatta. The Regatta takes place just before the Colombo race week, and is one of the events of the year, everyone goes, the men in their best coat and tile, and the ladies in their smartest frocks. Three crews entered for the race, viz.: the Colombo, Royal Warwick Regt., and R.A., the Colombo boat was favourite, they had been at work for nearly two months and rowed in good style, the other two crews had only been together for eight or ten days and were a bit rough, but each boat had plenty of supporters who believed in muscle and condition. On the 10th August the first heats were rowed off. The course is on the big lake in Colombo and is 1 mile 600 yards long, a pretty course, but not good for seeing the finish, the spectators being too far from the winning-post. The R.A. having drawn a bye, the Colombo and Royal Warwick Regt's. boats rowed the first heat, the Colombo boat jumped off with the lead and won easily by four or five lengths. On the 12th the Regatta took place, there was a good deal of excitement about the fours, the Colombo boat being a strong favourite. Immediately after the start the Colombo boat went to the front and, at the end of a mile, were leading by some five lengths, but the pace was beginning to tell on the civilians, while the R.A. were only beginning to settle down, rowing a stroke of 39 they overhauled the Colombo boat at every stroke, and putting on a spurt at the end, beat the civilians on the post by half a length; it was a hard fight, and the R.A. rowed a plucky race; a quarter of a mile from home odds of 20 to 1, no takers, were offered on the civilians. The winners received a small ovation on their return; it was not a bad performance considering the small amount of practice they had, and that there was no one to choose from, it being a half-company boat and the four officers all rowing. This is the crew:

		st.	lbs.
Major Hickman	(bow)	9	3
Lieut. Farquhar	(2)	11	0
„ Hewetson	(3)	11	0
„ Kirkpatrick	(stroke)	10	12

There were plenty of other events but only of local interest, the rain came down like a waterspout towards the end, spoiling half the show.

The 16 Company, Southern Division, R.A. sports came off the middle of September, there is nothing much to record about them; they were a success, and everything went off well, but one misses the "Hairy" sadly in Garrison Battery sports. Lieut.-Col. Nash kindly presented a cup for the winner of the greatest number of events. This was won by Corporal Marlow, a smart man at all games and sports, and a good soldier; a very popular win.

In July last seven of the R.A. here gave a dance, Capt. and Mrs. Block kindly gave up their house for the occasion. It was a rather ambitious undertaking, the whole of Colombo and a number of up-country people being asked; about 130 people turned up. The decorations were very pretty, and all the arrangements would have been hard to improve on. The garden was quite a scene from fairy-land, the ferns and palms, with Chinese lanterns hung among them, and small lamps on the ground, made a wonderfully pretty and effective scene, and when you add "brave men and lovely women" (at least they're all supposed to be that at Colombo), with drinks galore (they are a thirsty race in Ceylon), and Kala juggers, and bowers of bliss to suit all, what could the heart of man or woman require more? Space forbids my entering into details of the smart frocks, undoubtedly though they require seeing to be appreciated. The floor was good and the music good, and altogether the dance was a great success and the talk of the place for long afterwards. It was the first dance given by the R.A. in the memory of man; but what can be done without a Mess.

DOVER.

The R.A.C.C. Dover, during the past season played 18 matches, of which they won 10; amongst the opposing teams were the Regiments in Garrison, Cavalry Depôt; R.M.L.I., Walmer; the King's Dragoon Guards, Royal West Kent Regt., Shorncliffe; and other local clubs.

Lieut. H. M. Barnes was captain and Lieut. Hutchinson secretary.

The best averages were as follows:—

C.S.M. Lindley	24·67
Lieut. E. L. Tomkins	16·7
" H. M. Barnes	12·27
" F. P. Hutchinson	11·22

Lieut. Barnes took 108 wickets for 863 runs
Corpl. Paitson " 63 " " 630 "

The question of separate cricket grounds for the Western Heights and Castle is receiving the consideration of the authorities; the present arrangement is very unsatisfactory, there being only one small ground situated in the town and shared by the Dover C.C., R.A. and three Regiments. It is to be hoped that the R.A. will have a ground of their own before long.

On the 16th August Colonel Lloyd and officers gave a large garden party at the Castle. A portion of the band (strings) from Woolwich played on the lawn, and was very much appreciated. The armoury at the Keep and some of the underground passages were additional attractions.

On the 9th September the R.A. Athletic Sports took place on the North Fall Meadow in lovely weather. A large number of visitors and friends assembled. The band from Woolwich again attended and added considerably to the success of the meeting. Besides the usual events were an "Umbrella and Saddling race," won by Mr. Leather, 5th Fusiliers, which caused much amusement. The flat race for officers was won by Lieut. Hutchinson.

The Dover golf links, on the North Fall Meadow, are just now much patronised by the gunners. The greens are treacherous and the lies, as a rule, bad, and very straight driving and careful approaches necessary to avoid the long grass slopes of the Castle ramparts on one side, and a road, hedges and fields on the other.

On the 6th September teams of officers from the R.A., Militia and Volunteer Artillery met to compete for the Challenge Cup, presented by the Cinque Ports Artillery for carbine shooting, which was for the second time won by the R.A.

On the 5th October H.R.H. the Duke of Cambridge lunched with Col. Lloyd and officers, on the occasion of H.R.H.'s annual inspection. Major-General Clarke, D.A.G.; Major-General Williams, D.A.G., R.A.; and Colonel Fitz-George, A.-D.-C., were also present.

The Mess Committee desire to record their thanks to the R.A.I. Committee for the loan of a pair of very fine ibex horns, and also to Major T. Vaughan for so kindly sending three excellent heads of animals shot in Thibet, in response to appeal inserted in the September number of these "Proceedings."

HALIFAX, N.S.

Woodcock shooting began on 20th August. The best bag made was by Lieutenant Macgowan and two guns, who got 42 couple in three days.

Lieutenant H. M. Elliot has been appointed Acting-Adjutant of the R A. Halifax District vice Marsh, whose four years' term of office has expired.

Lieutenant Macgowan has imported five couple of foxhounds from England and Ireland to hunt wild cats, or, properly speaking, lynxs during the late autumn and early winter.

The recent return of Colonel Hill, C.R.E., and a party of two officers and 40 N.-C.O.'s and men of the Royal Engineers from Newfoundland, where they were sent to render assistance after the great fire at St. Johns, serves to remind of the time, 23 years ago, when that place was garrisoned by British troops and, of course, by Royal Artillery. It may be of interest to some officers who were in the Regiment then to recall to mind the names of the principal fortifications in the Island and their armaments. They were as follows :—

Fort William—Three 32-prs., four 40-prs. Armstrong, four 6-pr. brass guns for saluting, and one 13-inch mortar.
Fort Amherst—Five 68-prs.
Chain Rock Battery—One 68-pr. and two 32-prs.
Queen's Battery—Six 32-prs. and one 12-pr. (time gun).
Waldegrave Battery—One 68-pr. and three 32-prs.
Quidi Vidi Battery (pronounced Kiddy Viddy !)—Two 8-inch howitzers.

Now-a-days the works have been demolished, the armaments disappeared, and the Island is practically undefended except by the ships of war. During the time of the "Trent affair" the transports from Great Britain to Canada used sometimes to touch at St. Johns, and there is an interesting official letter amongst the files in the R.A. office at Halifax, dated 3rd February, 1862, from Major McCrea, C.R.A., at St. Johns, to Colonel Dunlop, C.B., C.R.A. at Halifax. reporting the vicissitudes that Captain Smyth's (now Sir Henry Smyth, Governor of Malta) Field Battery, "H" of the old 4th Brigade, had undergone during the voyage out in the transport *Calcutta*, in which she encountered terrific weather, lost her fore topmast, bowsprit, head rails, boats, and five out of 42 horses. The crew behaved badly, and, having deserted the helm, were kept to their duty afterwards by gunners at the point of the bayonet. She ran short of coal, and finally, after being 23 days out from Queenstown, arrived off St. Johns, but was unable to enter the harbour on account of ice. She was towed

into the Bay of Bulls, 25 miles to the southward, and eventually got into St. Johns, where she re-coaled and provisioned, and then proceeded to Halifax.

On 31st August last, Major Brady's Company (No. 3 Western) fired its annual competitive practice from the 9-inch R.M.L. guns at York Redoubt at a towed target, and, making a total of 262 credits, qualified as a 1st Class Prize Company. The 6-pr. Q.F. guns, mounted for the defence of the mine-fields, were fired for the first time the same day, under the superintendence of Lieut.-Colonel Saunders.

On 15th September, moose hunting, as it is called, began. Captain Boileau was out for 10 days in Cumberland County with the well-known Indian hunter, Abe Hood, and two other Indians, but did not get a shot, his chances of sport being seriously interfered with by one of the men falling sick in the middle of the woods. On 1st October, Lieutenants Marsh and Macgowan went out moose hunting on 10 days' leave in Shelbourne County, the latter officer securing a fine bull. They had a very rough time of it, the weather being wet and foggy, and Lieutenant Macgowan, having parted company with his Nova Scotian hunter, was alone in the woods for three days, lost his way, and only just managed to reach the standing camp, carrying his rifle and a load of 70 lbs. on his back, and having had only moose flesh and a few biscuits to eat during his absence.

Major and Mrs. Crookenden have gone to Niagara on short leave.

Major Fergusson, A.D.C., Rifle Brigade, and Lieutenant White, A.D.C., Grenadier Guards, have returned from a two month's shooting trip to the Rocky Mountains, during which they got one grizzly bear, one black bear, 11 elk, two wild sheep, and one black-tailed buck.

Major Brady, R.A., proceeded to Quebec and Montreal in H.M.S. *Tartar* on a month's leave as the guest of the Captain (Commander Fleet), but, unfortunately, on his arrival at Montreal he received news by cablegram which necessitated his going home by the first mail steamer, and is now in England on leave until 1st December.

On 3rd October, General Sir John Ross, Miss Ross, Colonel Hill, R.E., Major Waldron, R.A., and Mrs. Waldron, returned to Halifax from their five weeks' trip to the Pacific Coast. Mr. Van Horne, the President of the C.P. Railway, placed his private car, which contains dining-room, sitting-room, bedrooms, kitchen, etc., also his *chef* at the disposal of the General, so he and his party travelled comfortably, and had the additional advantage of being able to attach the car to any train, or have it taken off at any place at which they wanted to stop. They went right through to Vancouver, the Western terminus, and then crossed over by steamer to Victoria in Vancouver Island. Some of the places they visited both going and coming were Montreal, Toronto, Niagara, Winnipeg, Calgarry, Banff, and Chicago.

On 8th October, the R.A. Annual Regimental Sports were held in the Riding Ground at Halifax, and were voted a great success. The day was a perfect one, and the band of the 1st Leicestershire Regiment played during the afternoon. The Committee were fortunate in having Major Crookenden, who has always been so much associated with games, as their President, while Master-Gunner Howlett, who is an old hand at athletic sports, as the senior member of the Sub-Committee, undertook most of the preliminary arrangements and executed them admirably, forgetting nothing. Lieut.-Colonel Saunders acted as referee, and Mrs. Crookenden kindly distributed the prizes.

OBITUARY.

Lieut.-General C. S. Henry, C.B., Royal Artillery, died at the Pavilion, Melrose, N.B., on the 5th October, 1892, aged 69 years. He joined the Army 18th June, 1842; became Captain, 19th May, 1849; Brevet-Major, 17th July, 1855; Brevet Lieut.-Colonel, 2nd November, 1855; Colonel, 2nd November, 1863; Major-General, 17th May, 1869; Lieut.-General, 1st October, 1882; and Colonel-Commandant, 14th August, 1887. He served in the Crimean Campaign of 1855, in the trenches with the Siege Train before Sebastopol (severely wounded), and at the bombardment of 9th April, 6th and 17th June (medal with clasp), brevet of Major and Lieut.-Colonel, Sardinian and Turkish medals, 5th Class of the Medjidie, and C.B.)

Surgeon-General R. C. Elliot, C.B., retired list, Army Medical Staff, died at Devonport, on the 6th October, 1892, aged 75 years. He joined the Army Medical Department, 7th June, 1839; became Surgeon, 1st January, 1853; Surgeon-Major, 21st May, 1855; Deputy-Inspector-General, 11th October, 1864; Surgeon-General, 28th February, 1876; and retired 28th June, 1876. He served throughout the Eastern Campaign of 1854–6, including the affairs of Bulganac and M'Kenzies Farm, battles of Alma, Balaclava, and Inkerman, and siege and fall of Sebastopol. After promotion to the post of Senior Surgeon to the Royal Artillery, he was appointed Superintendent-Surgeon to the whole of the Ordnance Corps in the Crimea (medal with four clasps, Knight of the Legion of Honour, 5th Class of the Medjidie and Turkish medal; thrice mentioned in despatches). Served during the Indian Mutiny, 1857–59, and was present at the action of Pandoo Nuddee, operations before Cawnpore, 27th, 28th, and 29th November, under General Windham, and battle of Cawnpore, 6th December (mentioned in despatches, medal).

Major-General G. Shaw, C.B., Colonel retired list, Royal Artillery, died at 63, Wood Street, Woolwich, on the 12th October, 1892, aged 69 years. He joined the Royal Artillery 18th June, 1842; became Captain, 9th April, 1849; Major, 2nd November, 1855; Lieut.-Colonel, 20th September, 1863; Colonel, 20th September, 1868; and retired with the honorary rank of Major-General, 1st July, 1877. He served in the Crimean Campaign of 1855, in the trenches with the Siege Train before Sebastopol, and at the bombardments of 9th April, 6th and 17th June, 17th August, and 8th September. (Brevet of Major, medal with clasp, Sardinian and Turkish medals, C.B., and 5th Class of Medjidie.)

Colonel T. W. Hicks, C.B., retired list, Royal (Bombay) Artillery, died at Bellevue, Higher Hoe, near Plymouth, on the 9th October, 1892, aged 85 years. During the Indian Mutiny the deceased commanded the Artillery of the Central India Field Force, and greatly distinguished himself at the capture of Gwalior by leading the charge in which the Ranee of Jhansi was killed, for which service he was made C.B.

Captain G. L. W. Grierson, R.H.A., whose death from cholera occurred at Lucknow, on 17th October, joined the Regiment as Lieutenant on 18th February, 1880, and became Captain, 31st January, 1888. He served in the Afghan War, 1880 (medal), and the Bikanir Expedition, 1883–4.

Captain J. Saltren-Willett, *late* R.A., died at Petticombe, N. Devon, on 20th October, 1892. He joined the Regiment as 2nd Lieutenant, 19th June, 1841; became Lieutenant, 12th April, 1842; 2nd Captain, 30th June, 1848; Captain, 20th, June, 1854; and resigned 29th May, 1855.

CRICKET, 1892.

Matches played, 15. Won, 2. Drawn, 5. Lost, 8.

Batting Averages.

Names.	No. of Innings.	Runs.	Most in an Innings.	Times not out.	Average.
Captain P. H. Dorehill	13	393	83	—	30·3
E. J. R. Peel	10	295	75	—	29·5
H. D. White-Thomson	8	233	75	—	29·1
J. P. DuCane	11	310	106	—	28·2
Captain G. F. Herbert	4	84	45	1	28
" F. A. Curteis	27	721	90	—	27·19
F. W. D. Quinton	15	418	106	—	27·13
A. E. J. Perkins	20	478	94	—	23·18
Captain H. R. Adair	4	69	51*	1	23
Sergeant Cochrane	20	345	63	1	18·3
Captain J. Wynne	13	166	47	1	13·10
" E. S. Cooper	6	72	21	—	12
" A. J. Abdy	11	131	51	—	11·10
E. G. Waymouth	4	33	16*	1	11
Bombardier Butler	25	206	24	5	10·6
H. R Palmer	4	30	21*	1	10
Captain H. M. Campbell	7	50	29	1	8·2
Sergeant Bates	5	32	14	1	8
H. M. Barnes	9	67	28	—	7·4
W. H. Perrott	9	43	17	3	7·1
Corporal Bailey	10	50	16	3	7·1

Besides 23 other players of a few innings only.

* Not out.

As the bowling score was not kept at some of the out matches no analysis is possible, but during the season

Bombardier Butler	bowled	55	wickets.
Sergeant Cochrane	"	26	"
Sergeant Bates	"	16	"
H. M. Barnes	"	14	"
A. E. J. Perkins	"	14	"
Capt. Dorehill	"	11	"

DIARY OF FIXTURES.

NOVEMBER.

Day of the Mth.	Wk	Regimental.	Cricket, &c.	Private.
1	T	... ...	... ...	... ...
2	W	... ...	... ...	... ...
3	Th	... ...	... ...	... ...
4	F	... ...	... ...	... ...
5	S	... ...	... ...	... ...
6	S	... ...	... ...	... ...
7	M	Lecture at R.A.I. at 5 p.m., by Professor C. V. Boys, F.R.S., on "Photographs of Flying Bullets, &c."	... ...	... ...
8	T	... ...	... ...	... ...
9	W	... ...	... ...	... ...
10	Th	... ...	... ...	... ...
11	F	R.A. Band Concert at 3 p.m.	... ...	... ...
12	S	... ...	... ...	... ...
13	S	... ...	... ...	... ...
14	M	... ...	... ...	.. ...
15	T	... ...	... ...	... ...
16	W	R.A. Band Concert at 3 p.m.	... ...	... ...
17	Th	... ...	... ...	... ...
18	F	... ...	... ...	... ...
19	S	... ...	... ...	... ...
20	S	... ...	... ...	... ...
21	M	... ...	... ...	... ...
22	T	... ...	... ...	... ...
23	W	R.A. Band Concert at 9 p.m.	... ...	... ...
24	Th	... ...	... ...	... ...
25	F	... ...	... ...	... ...
26	S	... ...	... ...	... ...
27	S	... ...	... ...	... ...
28	M	Lecture at R.A.I. at 9 p.m., by T. M. Maguire, Esq., LL.D., on "The Strategical Geography of Western Europe."	... ...	... ...
29	T	... ...	... ...	... ..
30	W	R.A. Band Concert at 3 p.m.	... ...	... ...

DECEMBER.

1	Th	... ...	... ...	... ...
2	F	... ...	... ...	... ...
3	S	... ...	... ...	... ...
4	S	... ...	... ...	... ...
5	M	... ...	... ...	... ...
6	T	... ...	... ...	... ...
7	W	R.A. Band Concert at 9 p.m.	... ...	... ...
8	Th	... ...	... ...	... ...
9	F	Special Class leave Woolwich	... ...	... ...
10	S	... ...	... ...	... ...
11	S	... ...	... ...	... ...

DECEMBER.—*Continued.*

Day of the Mth.	Wk.	Regimental.	Cricket, &c.	Private.
12	M	Lecture at R.A.I. at 5 p.m., by Capt. C. Orde-Browne, on "The Story of Arms and Armour."	... ...	... ...
13	T	... ...	.. ...	... ...
14	W	R.A. Band Concert at 3 p.m.	... ...	... ...
15	Th	... ...	... ...	... ...
16	F	... ...	... ...	... ...
17	S	... ...	... ...	... ...
18	S	... ...	... ...	... ...
19	M	... ...	... ...	... ...
20	T	... ...	... ...	... ...
21	W	... ...	... ...	... ...
22	Th	... ...	... ...	... ...
23	F	... ...	... ...	... ...
24	S	... ...	... ...	... ...
25	S	Christmas Day.	... ...	... ...
26	M	Bank Holiday.	... ...	... ...
27	T	... ...	... ...	... ...
28	W	... ...	... ...	... ...
29	Th	... ...	... ...	... ...
30	F	... ...	... ...	... ...
31	S	... ...	... ...	... ...

NOTES
FROM
CORRESPONDING MEMBERS.

The subject for the Duncan Gold Medal Prize Essay, 1893, is "The Attack of a Coast Fortress."

Attention is called to the Rules for Prize Essays printed at the end of the Rules R.A.I., and Officers are asked to be careful in posting their Essay intended for competition in time to reach the Secretary on or before the 1st of April.

Any member who wishes can receive, at the cost of stitching and binding, about 3s., a copy of the "Cleaveland Notes on the Early History of the Royal Regiment of Artillery. A.D. 1267—1757."

In order to bring the already existing printed Records of the R. M. Academy up to date, it has been found that there will be a much larger amount of letter-press to be added than was at first anticipated. In consequence of this it has become necessary to raise the estimated price per copy from 12s. 6d. to 15s.

Any Officer who may wish for a copy is requested to send his name and address to the Secretary, R.M.A., Woolwich.

Copies of examination papers in subjects (*c*), (*d*), and (*e*) are on sale at the R.A.I. The last sets comprise questions set in four examinations ending May, 1891. Price, Lieutenants (*c*), (*d*), and (*e*), 1s.; Captains, (*c*) and (*d*), 9d.

The Committee will be glad to receive from any Member the name of such books as he may think desirable for purchase for the R.A.I. Library.

The following works are now on sale at the R.A. Institution and will be forwarded post free at the prices noted after their titles below :—

Major-General Stubbs's "List of Officers of the Bengal Artillery," price 5s. 3d.

"Field Artillery Fire," by Captain W. L. White, R.A., price 1s. 2d.

"Notes of Lectures on Artillery in Coast Defence," by Major A. C. Hansard, R.A., price 1s. 2d.

"Ranging Note-Book," by Captain S. W. Lane, R.A., price 1s. 1d.

GAMES' FUND.

This fund was originally started to provide funds for the Annual Inter-Regimental Racquet and Billiard Matches and to secure a representation of the regiment by the best player in each event without putting individuals to great cost.

The fund has since been further devoted to expenditure on anything, which in the opinion of the Committee, tends to permanently help the recreation of R.A. Officers; under this head a very large number of grants have been made with

various objects to stations of R.A. all over the world. The list given below is that of grants made during the last ten years only; in that time no application has been refused by the Committee, if its object would be of permanent benefit, and in making the grant the Committee have not been influenced by the number of subscribers to the fund in the station making application.

Station.	Object.	Amount. £	s.	d.
1882.				
Dover	Hire of cricket ground	10	0	0
Aldershot	Enlarging cricket ground and laying down lawn tennis courts	30	0	0
1883.				
Guernsey	Lawn tennis courts	5	0	0
Sheffield	Asphalte lawn tennis courts	25	0	0
Christchurch	Cricket ground	10	0	0
Hilsea	Lawn tennis courts	10	0	0
Shorncliffe	Lawn tennis courts	5	0	0
Colchester	Lawn tennis courts	15	0	0
Tilbury	Lawn tennis courts	5	0	0
Camden Fort	Purchase of a boat	10	0	0
R.A. Egypt	Cricket material	7	0	0
Limerick	Hire of cricket ground	6	0	0
Dover	Hire of cricket ground	10	0	0
Southsea Castle	Lawn tennis courts	10	0	0
Guernsey	2nd lawn tennis court	5	0	0
Aldershot	Cricket ground	25	0	0
1884.				
Leith Fort	Lawn tennis ground	7	10	0
Aldershot	To complete cricket ground	10	0	0
Shoeburyness	Repair of stiké court	10	0	0
Dover	Hire of cricket ground	5	0	0
Bristol	R.A. cricket ground	15	0	0
Woolwich	R.A. lawn tennis courts	5	0	0
1886.				
Newport	Lawn tennis courts	7	10	0
Portobello, Dublin	Lawn tennis courts	15	0	0
Ipswich	Lawn tennis courts	15	0	0
Fort Rowner, Gosport	Lawn tennis courts	8	0	0
Sheffield	Hire of cricket ground	5	0	0
Canterbury	Lawn tennis courts	5	0	0
1888.				
North Camp, Aldershot	Mower for cricket ground	10	0	0
Fort Grange, Gosport	Lawn tennis court	10	0	0
Yarmouth	Cricket ground	20	0	0
R.A. Cricket Ground	Painting Pavilion	10	0	0
Golden Hill, I. of W.	Lawn tennis court	10	0	0
1889.				
Colchester	Lawn tennis courts	10	0	0
Sialkot	Well for polo ground	25	0	0
Shoeburyness	New boats	45	0	0
Newbridge	Lawn tennis court	5	0	0
R.A. Drag Hunt	Drainage of kennels	5	0	0

1890.

Station.	Object.	Amount. £	s.	d.
R.A. Cricket Club	Screens	25	0	0
Malta	Cricket and lawn tennis grounds	25	0	0
Lydd	Cricket ground	25	0	0
Polo Club, Woolwich	Pavilion	50	0	0
R.A. Drag Hunt	Kennels	25	0	0
1891.				
Fort Grange, Gosport	Lawn tennis court	10	0	0
Weedon	Mower for tennis and golf greens	30	0	0
1892.				
Trowbridge	Lawn tennis court	10	0	0
Seaforth, Liverpool	Stiké court	15	0	0
Shoeburyness	Cricket pavilion	25	0	0
Spike Island	Stiké court	15	0	0

The fund is now fairly prosperous ars regards money in hand. but the list of subscribers is rather curiously made up; the greater number of Field Officers and Captains in the Regiment subscribe, but of the 770 Subalterns only 15 are subscribers. The Committee feel sure that its benefits have only to be made known for many more Officers to subscribe to the fund.

The Committee as now constituted are: —

Colonel S. Parr Lynes, *President*
Colonel A. Harness, C.B.
„ J. Alleyne, C.B., A.-A.-G.
Lt.-Col. P. L. Macgregor.
Captain A. J. Abdy, R.A., *Hon. Sec.*

All applications for grants should be made to the Hon. Secretary, R.A. Games' Fund, Woolwich.

The rates of subscription are :—

	s.	d.	
Senior Officers	optional		
Lieut.-Colonels	9	0	per annum.
Majors	7	0	per annum.
Captains	5	0	per annum.
Subalterns	3	0	per annum.

Intending subscribers should sign the form below, cut it out and forward it to the Hon. Sec. R.A. Games' Fund, Woolwich.

GAMES' FUND.

Messrs. Cox & Co.,

Please pay the Annual Subscription of my rank to the "R.A. Games' Fund" until further orders, commencing from

Date _____

Name and Rank _____

DOVER.

The R.A. Dover record with regret the departure on leave, prior to joining at the Staff College, of Capt. R. A. K. Montgomery, at the same time congratulating him on his well-deserved success. Also of Capt. J. S. Douglas, appointed I.W.S. at Mauritius. There have been several other changes: Major J. W. M. Newton transferred to 40th Field Battery, Lieut. A. W. Stockley to a Divisional Adjutancy, Plymouth, and a vacancy in the Depôt has been caused by the sudden and unexpected death of Lieut. Richard Morley, which occurred at Westgate-on-Sea, early in November.

No. 17 S.T. Company has a very strong Association Football team, defeating nearly every club in the neighbourhood, though they were beaten by the Royal West Kent Regiment team in their tie for the Kent County Association Cup, but they made a very plucky fight against this formidable team which runs a fair chance of winning.

Under the auspices of the Dover Winter Amusement Committee and management of Capt. Moore-Lane, R.A., amateur theatricals were given at the Town Hall on the 7th and 8th November. The piece presented was "Young Mrs. Winthrop," and the following is taken from a local paper:—"Mrs. Dick Chetwyn was taken by Mrs. Breakey (wife of Capt Breakey, R.A.) with a degree of skill in bringing out the irony and humour of the part that could hardly be overpraised, and displayed a talent which places her in the front rank of amateur actresses. Her versatility of acting, and her volubility, accompanied by a ripple of merry laughter in describing her matrimonial embarrassments, were charming."

At the Annual Municipal Banquet given by the Mayor of Dover on the occasion of his election, to which the officers of the garrison were invited, Col. Lloyd, C.B., Commanding R.A., in the absence, on leave, of Major-General *Lord* William Seymour, returned thanks for the Army. In a speech, full of vigour, he commented on the defences of Dover, advocating the construction of a large Man-of-War harbour, and alluded to the great increase of knowledge and labour expected from soldiers now-a-days, many of them being jacks-of-all-trades: from engineers and mechanics even to being required to have a knowledge of photography, of ballooning and cycling, and the pleasure it gave him to bear witness to the fact that soldiers were quite ready to do these duties without grumbling.

No. 2 Company, Eastern Division, is to be congratulated on the high place (sixth) obtained by their army signallers at this year's inspection.

Dover is looking up in the coast defence line. A Watkin position-finder has arrived and will soon be installed. The strengthening of the Pier turret is at last completed, and so some interesting gun practice is to be expected next year.

GIBRALTAR.

As it is some months since any Notes have been published from this station, the following may be of interest to R.A. readers.

There have not been many changes of officers during the last year; the chief one was the transfer of Major-General Forster to Chatham. He was exceedingly popular here, and on his departure was rowed to his steamer by a crew consisting of officers, the men manning the ramparts, and giving him a hearty cheer. We may also be much congratulated in his successor, Major-General Smart. Things Regimental go here very smoothly and satisfactorily, even the District Staff at last making gigantic advances. As regards sports, which appear the staple subject of the Notes, Polo has gone very strong, and the pick of our talent here would have a good look in anywhere.

The Polo Tournament took place in July, and the final was a severe struggle between the R.A. and 60th Rifles. The 1st R.A. Team was just beaten by 5 goals to 4. The 60th then had to play our 2nd Team who, strange to relate, collared them even closer, and the goals had to be widened before the 60th could obtain a lucky win. If our teams had been more reasonably proportioned, there is no doubt, we would have romped in. Where so many were good it is hard to pick, but as a dashing "forward" Peel is hard to beat, while Jackson as "back" is as useful as can be.

In the Cricket world we have also done very well, winning and drawing most of the Inter-Regimental matches, and finally winning the Governor's Cup, which was presented for the first time this year. Peel and Straubenzee (whose absence is much lamented) did most in the batting, as also did Sergeant Leggett; while as a bowler, Sergeant Goodall has been a terror to the garrison.

In the Spring the Channel Fleet gave two Cups to be rowed for by both officers and men of the different Corps in garrison. Each of these events were won by the R.A., who were coached by our Brigade-Major, Fletcher.

The Gymkhana Club has run its meetings every fortnight with great success and large entries. The R.A. secured much more than their fair share of prizes; Peel and Gillson being especially greedy. The judging was carried out with positively "no complaints" by Colonel Bally, and subsequently by Major Harrison. A word of credit is due to the Secretary, Lieut. T. A. Bigge, R.E. (well known to R.A. Cricketers), for his indefatigable zeal and management.

In the racing world, perhaps, fortunately (as prominence in this line at Gibraltar is generally followed by disaster), the R.A. have not done much, the only animal of mark being a half-bred Arab and Barb mare belonging to that genuine sportsman, Captain Short. In the Sky Polo Meeting, however, we ran very close to sweeping the board, winning all the races except two, where we ran good seconds, being just beaten in each race by those formidable riders the 60th.

Hunting began the first week in November. They did very little cubbing, as the country kept too hot and dry, but have now gone for a week to one of the Master's Farms, about 16 miles on the Eastern Beach. Mr. Pablo Larios continues in his second year as Master. His last season was very successful and he has fulfilled all the high expectations that were formed of him. As a principal landowner he can go without molestation where he likes, and his general arrangements have been very good.

A new departure has been made this year. Instead of relying on the charity of good-natured M.F.H.'s we have formed a Kennel Fund, and bought our own drafts from the most suitable packs. Our new entry are chiefly from the New Forest and Old Berkshire, and the countries being somewhat similar (with apologies) the draft ought to do very well here. Short and Peel will be whips this year, the other two being Winn, A.-D.-C. Rifle Brigade, and Munro, Infantry Brigade-Major. The Master has been very energetic in thinning the congested districts, and putting down foxes in the emptier coverts; so with our present staff we expect to have the best of sport during the ensuing winter. The "kills in the open" being, it is to be hoped, more numerous than usually falls to the lot of the Calpe Hunt.

The Point-to-Point in the spring was, as far as we were concerned, rather a *fiasco*. The bulk of our talent relying on the large experience of the "Antient Pistole" of the station (at present serving elsewhere) took a line of their own covering about four-and-a-half miles where less than two was required. The amusing feature of the race was the professional finish of two of this party, who were happily oblivious that the riders of the other line had been in a quarter of an hour.

Another incident of interest during the year was the final Tug-of-War between

the R.A. and Black Watch which ended in a win for us, after a struggle of abnormal duration, resulting in the total collapse of one Black Watchman who required all the doctor's skill to resuscitate him.

GLASGOW.

The officers of the 7th Field Battery quartered at Maryhill Barracks gave a very successful Dance on Tuesday, 25th October, in the Gymnasium there. About 100 guests were present, and the music was supplied by the Band of the 1st Royal Scots Fusiliers. The room was beautifully decorated with trophies of arms and quantities of flags, the latter having been kindly lent by the officers of H.M.S. *Superb* (at Greenock), and others. The supper was laid out in the gallery, and in addition to the ample sitting-out accommodation in the ball-room itself, two marquees were erected outside. A bell-tent was pitched in one corner of the room, flanked on the other side by a 12-pr. gun, with another gun at the far end of the room. The names of the battles in which the battery has taken part were suspended round the room.

A Grand Military Tournament got up by the 1st Royal Scots Fusiliers and some Volunteers was held in Glasgow on the 20th, 21st, and 22nd in Hengler's Circus, and also on the 27th, 28th and 29th October in the East End Exhibition, and was a tremendous success. The Exhibition which seats 6000 people was crammed on each occasion, and it is estimated that quite £1200 has been cleared. The R.A. gave every assistance with men and horses. Lieut. Crockett was on the Committee, and was superintendent of all the mounted events, which entailed a lot of hard work. The battle of Ulundi, shewing the square being attacked by Zulus, was one of the most realistic scenes ever depicted on any stage.

OBITUARY.

Lieutenant G. G. Boyle, R.A., who was drowned in the wreck of the s.s. *Bokhara*, off Pescadores, on 10th October, 1892, was commissioned as Second Lieutenant on 15th February, 1889, and became Lieutenant, 15th February, 1892.

Captain C. T. Head, R.A., died at Lucknow, on the 20th October, 1892, of cholera, aged 32. He joined the Army, 19th May, 1880, and became Captain, 1st October, 1888.

Lieutenant R. Morley, R.A., whose death occurred at Westgate-on-Sea, on the 29th October, 1892, joined the Regiment as Lieutenant, on 18th February, 1886.

General G. P. Sealy, Colonel-Comdt. Royal (late Bombay) Artillery, died at Ealing, on the 11th November, 1892, aged 80 years. He joined the Army 8th December, 1831; became Captain, 15th April, 1850; Brevet-Major, 27th September, 1859; Lieut.-Colonel, 30th March, 1860; Colonel, 1st September, 1863; Major-General, 6th March, 1868; Lieut.-General, 1st October, 1877; and General, 8th December, 1879. He served in the Campaign of 1838–9 in Afghanistan, including the storming and capture of Ghuznee (medal), in Persia in 1857 (medal with clasp), was at the relief of Kolapore, at the attack on insurgent Bheels at Dababunree and Gurbapawnee on 11th March, 1858, operations in the Santpore Hills in 1858 in command of Mountain Train and left attack (medal and Brevet of Major).

DIARY OF FIXTURES.

DECEMBER.

Day of the Mth.	Wk	Regimental.	Cricket, &c.	Private.
1	Th	... ...	... ...	... ...
2	F	... ...	... ...	... ...
3	S	... ...	... ...	... ...
4	**S**	... ...	... ...	... ...
5	M	... ...	... ...	... ...
6	T	... ...	... ...	... ...
7	W	R.A. Band Concert at 9 p.m.	... ...	... ...
8	Th	... ...	... ...	... ...
9	F	Special Class leave Woolwich	... ...	... ...
10	S	... ...	... ...	... ...
11	**S**	... ...	... ...	... ...
12	M	Lecture at R.A.I. at 5 p.m., by Capt. C. Orde-Browne, on "The Story of Arms and Armour."	... ...	... ...
13	T	... ...	.. ...	... ...
14	W	R.A. Band Concert at 3 p.m.	... ...	... ...
15	Th	... ...	... ...	... ...
16	F	... ...	... ...	... ...
17	S	... ...	... ...	... ...
18	**S**	... ...	... ...	... ...
19	M	... ...	... ...	... ...
20	T	... ...	... ...	... ...
21	W	... ...	... ...	... ...
22	Th	... ...	... ...	... ...
23	F	... ...	... ...	... ...
24	S	... ...	... ...	... ...
25	**S**	Christmas Day.	... ...	... ...
26	M	Bank Holiday.	... ...	... ...
27	T	... ...	... ...	... ...
28	W	... ...	... ...	... ...
29	Th	... ...	... ...	... ...
30	F	... ...	... ...	... ...
31	S	... ...	... ...	... ...

JANUARY.

1	**S**	... ...	... ...	... ...
2	M	... ...	... ...	... ...
3	T	... ...	... ...	... ...
4	W	... ...	... ...	... ...
5	Th	... ...	... ...	... ...
6	F	... ...	... ...	... ...
7	S	... ...	... ...	... ...
8	**S**	.. ...	... ...	... ...
9	M	... ...	... ...	... ...
10	T	... ...	... ...	... ...
11	W	... ...	... ...	... ...

JANUARY.—*Continued*

Day of the Mth.	Wk.	Regimental.		Cricket, &c.		Private.	
12	Th	...	...	...	...	...	...
13	F	...	...	...	...	...	...
14	S	...	...	...	...	...	...
15	**S**	...	...	...	...	...	...
16	M	...	...	...	...	...	...
17	T	...	...	...	...	...	...
18	W	...	...	...	...	...	...
19	Th	...	...	...	...	...	...
20	F	...	...	...	...	...	...
21	S	...	...	...	...	...	...
22	**S**	...	...	...	...	...	...
23	M	Lecture at R.A.I. at 5 p.m., by Lieut.-Colonel F. W. J. Barker, R.A., on "Modern Gunpowder and Cordite."		...	...	...	...
24	T	...	...	...	...	...	...
25	W	...	...	...	...	...	...
26	Th	...	...	...	...	...	...
27	F	...	...	...	...	...	...
28	S	...	...	...	...	...	...
29	**S**	...	...	...	...	...	...
30	M	...	...	...	...	...	...
31	T	...	...	...	...	...	...